THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XXIX JANUARY, 1933 No. 1

FACTORS INFLUENCING THE TYPES OF METASTATIC CARCINOMA OF BONE*

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MUCH has been written in the past concerning bone metastases, dealing with their frequency in the many bones, discussing the avenues of dissemination and describing their histological and roentgenological variations. There is little, however, to be found in the literature to explain adequately a relationship between these roentgenological variations and the analysis of the primary tumors. This paper is presented to discuss this latter phase of the subject.

Ewing[6] called attention to the radioresistance of tumors which contain marked desmoplasia and the radiosensitivity of tumors which are of a highly cellular, embryonal type. For this reason we adopted the plan in our laboratory, when describing the histology of the primary tumor, of recording the degree of anaplasia and desmoplasia. After studying a number of cases, it occurred to us that there is a distinct relationship between the desmoplastic reaction in the primary tumor and the types of bone metastases which are found. Subsequent review of additional cases has strengthened our belief in this observation, with the recognition that numerous exceptions are to be expected in so complex a process.

As early as 1834, soon after the beginning of the science of cellular pathology, bone metastases were recognized by Sanson in a case of carcinoma of the breast. In 1891, before the discovery of the x-ray, von Recklinghausen's[20] classical article appeared describing the existence of two types of bone metastases: one, diffuse and destructive, which he termed osteomalacia carcinomatosis; the other, sclerosing and of an osteoplastic character.

The subsequent development of the use of the roentgen ray has brought the existence of these two types of metastases prominently to mind and numerous writers have discussed them and proposed theories to explain their differences.

Kienböck[14] describes four types: (*a*) purely osteolytic metastases; (*b*) osteolytic metastases with bony cortex and inner trabecular system; (*c*) strongly mixed osteolytic and osteopoietic metastases; (*d*) purely osteopoietic metastases.

In explanation of the differences between the types of metastases, von Recklinghausen suggested that it is a non-infectious inflammatory reaction, dependent in part on circulatory changes and in part on chemical irritation, which is responsible for new bone formation in osteoplastic

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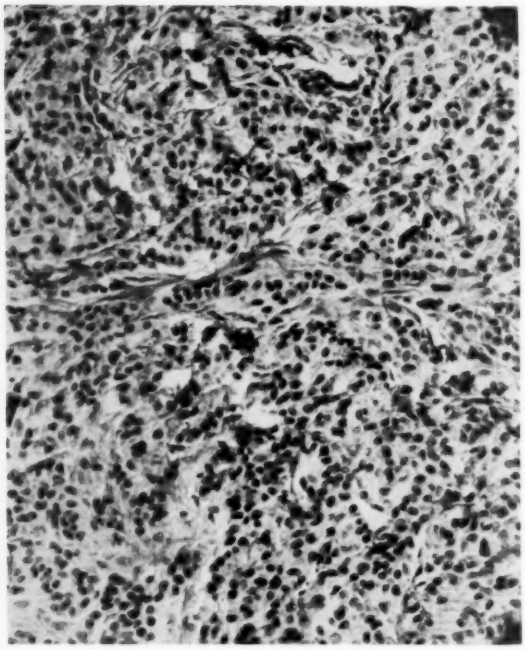

Fig. 1. Case 1002. Section of the primary tumor of the breast. Only small amounts of connective tissue. Some areas contained more fibrosis than is here shown (×200).

cases. This was supported by Courvoisier[4] and Kaufmann.[13] The circulatory changes mentioned have been of the nature of hyperemia, hemostasis and embolism and these often result in focal points of necrosis. A more diffuse necrosis of the bony trabeculae, resulting either from circulatory interference or from chemical changes induced by the cancer cells, is regarded by Askanazy,[1] Assmann[2] and others as the immediate exciting cause of new bone deposition on the surfaces of the trabeculae.

Axhausen[3] and Erdheim,[5] on the other hand, describe this deposition as occurring on trabeculae which are not necrotic. Axhausen's conception is related to the inflammatory theory, assuming the presence of a chemical substance produced by the cancer cells which acts upon the old bone cells to produce hyperplasia, or, more often, upon the connective tissue of the metastasis to cause a metaplasia to osteoblasts.

Some observers consider the rate or other characteristics of growth of the tumor and its metastases to be a determining factor.

Thiele[22] believes that the more infiltrating, the less sharply defined and the more slowly growing the primary neoplasm and its metastases are, the greater will be the tendency to osteoplastic change. Pfahler[19] says that sclerosis is probably an indication of Nature's attempt to isolate the disease and that it is more frequently found in cases that develop very slowly and in which the malignant process is not especially destructive.

Regarding the process of bone destruction, which occurs in both types of metastases in some degree, and which is of course the predominating characteristic of osteolytic lesions, many writers assume an osteoclastic capacity on the part of the cancer cells themselves. The epithelial cells are described as lying in immediate contact with the bone in the region of the destructive process. This theory was supported by

Fig. 2. Case 1002. Predominant lesions are destructive. Slight sclerosis occurring in the lumbar spine and pelvis.

Wolff,[23] Goetsch[11] and Levin.[17] On the other hand, Makrycostas[18] interpreted the picture to mean that specific osteoclasts have eroded the bone, but that these have been crowded out by the tumor cells. Von Recklinghausen pointed out the absence of special osteoclastic giant cells such as are found in osteoporosis. This observation has been confirmed by numerous workers. On the other hand, Axhausen interpreted the small spindle-shaped mononuclear connective tissue cells which he detected close to the walls of the lacunae as a special type of osteoclast. In this connection it is interesting to note that Leriche and Policard[16] regard the so-called bone cells of normal osseous tissue as accidentally encysted fibroblasts, which have no function in bone formation, are actually parasitic in this location and when activated, play the rôle of osteoclasts.

The possibility of chemical or physical resorption of bone without the intervention of any cell having phagocytic properties must be considered, and indeed this is the conclusion reached by von Recklinghausen.

It is generally assumed that the new bone deposited in osteoplastic lesions is laid down by osteoblasts derived either from the osteoblasts of the bone or by change of function from the fibroblasts supporting the tumor growth. Courvoisier suggests that cancer cells may take on the function of osteoblasts, but this would appear to be an improbable metaplasia and difficult to accept without considerable evidence.

Geschickter[8] recently expressed the opinion that the type of metastasis is dependent on the path of its entrance into bone. When the cells are blood borne, he believes that osteolysis results, and when the tumor reaches bone through lymphatic permeation, osteoplasia follows.

Leddy[15] made a study of a group of cases and stated that "there is no simple relationship between the histological character of the tumor and the incidence or type of metastasis." He makes no mention of the supporting tissue reaction, however, and one may infer from the briefness of his statement that it applies merely to the criteria upon which tumors are usually classified.

As stated above, we have noted an apparent parallelism between the desmoplasia of primary tumors and the appearance of osteoplasia in their metastases. This leads to the suggestion of the following theory:

If the primary tumor has the stimulus within itself to cause the growth of young connective tissue, whatever the nature of that stimulus may prove to be, then its cells when they metastasize in bone will exercise the same stimulus, producing osteoplastic change; conversely, highly cellular tumors without the power of exciting desmoplasia produce osteolytic metastases. Is it not rational to reason that since fibroblasts and osteoblasts are so closely akin, their reaction to a given stimulus would be quite similar?

In the estimation of the desmoplasia of tumors it must be borne in mind that there are two distinct factors present. In the first, the young connective tissue grows along with the advancing tumor cells and is interlaced between them, being a result of tumor stimulus—; in the second, the fibrous tissue is secondary to necrosis, the dead cells in this instance being the stimulus to a process of repair. This reaction is emphasized by Handley. A good example of this second type is found in many cases of scirrhous carcinoma of the breast, a condition which on first thought might be regarded as always an extreme illustration of the first type or true desmoplasia, but which is more often a cicatricial process following tumor cell degeneration. It is with the first type that we are most concerned in this study.

In making an analysis of all of our cases with bone metastases of which we have satisfactory sections of the primary tumor or of its recurrences or simpler metastases, Table 1 has been compiled.

After studying this table, one cannot avoid noticing the parallelism between the degree of desmoplasia in the primary tumor

and the amount of sclerosis in the bone metastases.

It is likewise to be noted that there are several instances of variation from the relationship which we suggest. This we would expect, since we do not assume the process to be a simple one or the factors affecting it to be few in number. The following considerations, in particular, we believe to account for some of the discrepancies.

First: We have observed that the earliest bone metastases are the most characteristic of the particular case. Subsequent lesions are apt to be influenced by metabolic or other factors. In particular, early sclerosing metastases are often followed by destruc-

TABLE I

Case Number	Age	Tumor	Primary Location	Degree of Desmoplasia	Types of Metastases
38	45	Carcinoma simplex	Breast	D	Destructive and sclerosing
63	53	Carcinoma simplex	Kidney	D	Destructive and sclerosing
67	74	Medullary carcinoma	Breast	O	Destructive
104	44	Carcinoma simplex	Breast	DD	Sclerosing
113	82	Carcinoma simplex	Breast	D	Destructive and sclerosing
173	53	Carcinoma simplex	Prostate	DD	Sclerosing and destructive
175	80	Carcinoma simplex	Prostate	D	Destructive
347	70	Carcinoma simplex	Breast	D	Destructive
435	61	Carcinoma simplex	Breast	D	Destructive and sclerosing
441	34	Carcinoma simplex	Breast	D	Destructive and sclerosing
450	81	Carcinoma	Prostate	DD	Sclerosing
486	59	Epidermoid carcinoma	Cervix	O	Destructive
505	56	Cystadenoma	Ovary	O	Destructive
540	38	Adenocarcinoma	Breast	O	Destructive
555	40	Carcinoma simplex	Breast	DD	Destructive and sclerosing
586	59	Squamous cell carcinoma	Vagina	D	Destructive
587	37	Medullary carcinoma	Breast	O	Destructive
610	64	Adenocarcinoma	Breast	D	Destructive
732	68	Hypernephroma	Adrenal	O	Destructive
821	69	Fibrocarcinoma	Bladder	DDD	Sclerosing
881	71	Mucoid carcinoma	Breast	DD	Sclerosing and destructive
938	43	Adenocarcinoma	Breast	D	Destructive
975	64	Carcinoma simplex	Breast	DD	Destructive and sclerosing
983	51	Carcinoma simplex	Breast	D	Sclerosing
1002	69	Carcinoma simplex	Breast	D	Destructive and sclerosing
1022	46	Adenocarcinoma	Kidney	O	Destructive
1025	62	Carcinoma simplex	Breast	D	Destructive and sclerosing
1182	69	Carcinoma simplex	Breast	D	Destructive
1214	58	Alveolar carcinoma	Breast	DD	Sclerosing
1219	39	Adenocarcinoma	Breast	D	Destructive and sclerosing
1223	44	Medullary carcinoma	Breast	O	Destructive
1273	50	Carcinoma simplex	Breast	DD	Destructive and sclerosing
1288	35	Squamous cell, Grade 3	Cervix	O	Destructive
1324	56	Carcinoma simplex	Adrenal	DD	Destructive and sclerosing
1401	68	Scirrhous carcinoma	Breast	DDD	Sclerosing and destructive
1421	80	Mucoid carcinoma	Breast	O	Destructive
*		Scirrhous carcinoma	Stomach	DD	Sclerosing
*		Adenocarcinoma	Thyroid	O	Destructive
*		Adenocarcinoma	Thyroid	O	Destructive

O = No desmoplasia
D = Mild desmoplasia
DD = Moderate desmoplasia
DDD = Marked desmoplasia

Where both destructive and sclerosing types are listed, the predominating characteristic is mentioned first.

* Cases seen outside the hospital.

tive lesions in other locations. We believe this change to be due to alterations in the calcium and phosphorus metabolism in the body, but thus far have been unable to carry out the studies required to confirm this view by biochemical evidence.

Second: Of the same etiology, but producing a different roentgen picture is the effect of osteoporosis existing prior to the occurrence of bone metastasis and due to senility, chronic constitutional disease or prolonged effects of localized malignancy. It seems apparent, since the bones are the storehouse of calcium, that, when a generalized osteoporosis exists, one need not expect calcification in new bone depositions formed in response to carcinomatous metastasis, regardless of the character of the stimulus exerted by the tumor. Such lesions would have the essential characteristics of osteoid tissue, but in the absence of calcium deposit would be recorded on the roentgen film as destructive processes. A study of the parathyroids might prove of interest in relation to these apparent changes in calcium metabolism, but thus far we have not had suitable cases.

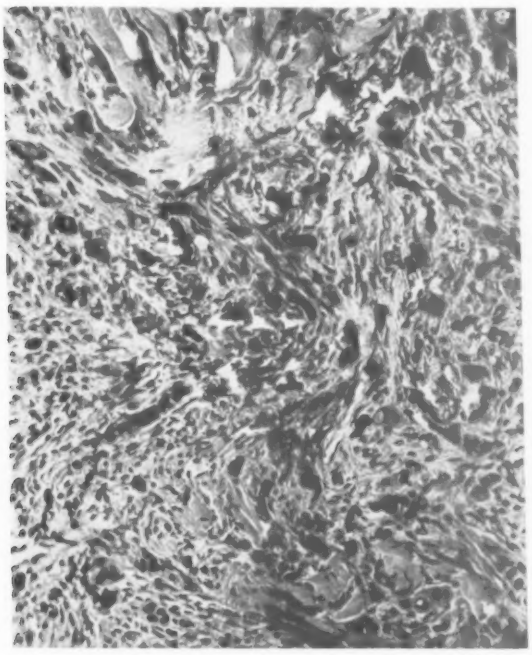

Fig. 3. Case 821. Fibrocarcinoma, primary in the bladder. A dense fibrous tissue in which lie groups and strands of cancer cells (×200).

Fig. 4. Case 821. Sclerosing lesions occurring in bones of extremities.

Third: There is the possible reaction in some of these cases to radiotherapy before the examination of the tissue from the primary lesion or recurrences. Tumor nodules, which have been exposed to prolonged irradiation, have often been examined histologically by us and usually show a fibrosis between the nests of cancer cells which is denser than, but often difficult to distinguish from, that produced by the tumor itself. In compiling Table 1, it has been difficult to avoid a certain number of quantitative errors due to this cause.

Fourth: In the consideration of the tumor desmoplasia, we have attempted to recognize only that due to the cancer growth primarily rather than the cicatricial fibrosis resulting from cell necrosis, and have therefore paid particular attention to the actively growing areas in the primary tumor.

It is thus obvious that a personal element is involved in the interpretation of the degree of desmoplasia in different cases, and that this will be reflected in our table. Practically all of the findings have been recorded without any knowledge of the roentgenographic studies.

That there is a stimulus acting on the mesoblastic elements of essentially epithelial tumors is well recognized, and that the

degree and possibly the character of this stimulus varies in individual cases is apparent to anyone who has studied them histologically. This has been noted by Ewing,[7] who says, "epithelial tumor cells exert a notable formative influence in connective tissue; they are desmoplastic." He later states that "an osteoplastic influence is exerted on bone tissue by some cancers." Geschickter and Copeland[9] write that abundant evidence is found microscopically to show the capacity of bone to react by direct transition of fibroblasts to osteoblasts in building osteoid tissue.

Fig. 5. Case 821. Sclerosing lesions occurring in bones of extremities.

One of the best examples of a tumor without any power of desmoplasia is the hypernephroma, and in none of these cases have we found a tendency toward sclerosis in the metastases. This finding is borne out by Geschickter and Copeland who say, "there is no evidence in hypernephroma of any marked attempt at fibro-ostosis or formation of new bone within the area of destruction."

Likewise, concerning sclerosing processes, many observers have called attention to the frequency of osteoplastic lesions resulting from a fibrocarcinoma of the prostate. Kienböck in his classification of bone metastases states that the destructive lesions are generally secondary to a medullary soft carcinoma, usually of the breast or thyroid in a young patient; that the strongly mixed metastases are in patients of higher age, the primary tumor being in various locations and usually scirrhous in type; and that the osteopoietic metastases are found in older men, the primary tumor being mostly a fibrocarcinoma of the prostate. An observation similar to this was mentioned by Stewart.

None of the writers quoted, however, have emphasized the identity of the stimulus in the primary tumor and in the metastases, nor studied the degree of tumor desmoplasia in this connection.

We have made no attempt to study the nature of this stimulus. Whether it is an irritant effect, characteristic of certain cancer cells, and producing an inflammatory or protective reaction as suggested by von Recklinghausen,[20] Handley,[12] Ginsburg,[10] and many others, or whether it is a part of the obscure biological relationship existing between epithelial cells and their supporting tissue must remain a subject for further cytological study.

CONCLUSIONS

An attempt is made in this paper to demonstrate a relationship between the connective tissue reaction in the primary

tumor and the type of its bone metastases. Our work, thus far, is by no means conclusive, since our series is small and there are numerous other important factors to be investigated. We trust that those who are interested in this subject will consider this suggestion when studying their cases of bone metastasis.

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CHOLECYSTOGRAPHIC DIAGNOSIS OF NEOPLASMS OF THE GALLBLADDER

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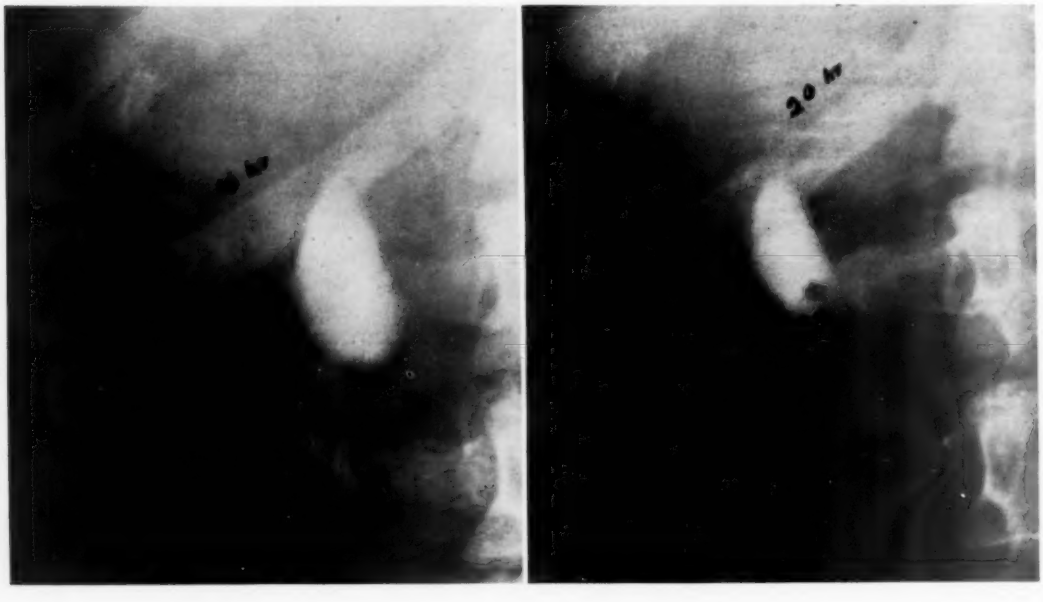
OTHER than identifying gallstones, a condition which can scarcely be considered a variety of cholecystic disease but rather a concomitant or by-product of such disease, the roentgenologist has not heretofore made any earnest attempt to distinguish the various affections of the gallbladder. For this there are two good reasons. First, most cases of cholecystic disease are comprised in the designation "chronic cholecystitis," which, despite varied etiology, produces fairly uniform clinical, roentgenologic and pathologic manifestations. Second, cholecystography, which is the chief reliance for roentgenologic investigation of the gallbladder, is primarily a test of function, that is, of the ability of the gallbladder to receive, concentrate and expel bile. Usually cholecystographic opinions are based solely on normal or disordered function, as shown by a dye shadow of normal density or one which is extremely faint or completely absent. Accordingly, the examiner usually reports his observations in terms of function. He realizes that a diagnosis of biliary health or disease would be purely inferential and feels that any effort to differentiate diseases would be futile.

However, when sufficient function is maintained to produce a shadow of the cholecystographic compound, the examination becomes comparable to that of the stomach and duodenum with the opaque meal. Not only are the shape, size, position and contractility of the gallbladder demon-



a *b*

FIG. 1. *a*, At the sixteenth hour the shadow of the gallbladder was apparently normal; *b*, at the twentieth hour a rounded shadow defect appeared at the fundal pole. This was attributed to a single cholesterin stone but at operation was found to be due to an adenoma.

* Read before the American Gastro-Enterologic Association, Atlantic City, N.J., May 3, 1932.

strable, but the conformation of its internal surface is also depicted, and any departure from the normal homogeneity and regular outline of the shadow is evident. In this way hour-glass deformity and certain anomalies, such as incisura, diverticulum and double gallbladder, can be shown. Cholesterin stones appear as central defects in the shadow, and often their presence can be determined only by this method. Obviously, nonobstructive neoplasms should be demonstrable also as shadow defects, similar to those produced by new growths in the stomach.

Pathologists consider benign tumors of the gallbladder to be rare, but papillomas were found in 8.5 per cent of more than 17,000 gallbladders surgically removed at The Mayo Clinic. Adenomas, fibromas, myomas and mixed varieties are also encountered. Of the malignant growths, sarcomas are extremely rare, but statistics indicate that carcinomas of the gallbladder constitute from 5 to 7 per cent of all carcinomas found at necropsy.

Until a little more than a year ago I had supposed that cholecystographic distinction between cholesterin stones and small new growths, especially papillomas, was virtually impossible. Among cases examined during 1930, however, was one in which a small rounded shadow defect near the fundus was interpreted as representing a single cholesterin stone (Fig. 1). When the gallbladder was removed at operation an adenoma was found at the site corresponding to the defect, and stones were not present (Fig. 2). Stimulated by this experience, I reviewed the morbid anatomy and cholecystographic data in the cases of papilloma in which operation had been performed at the Clinic. In the specimens examined, the papillomas were usually small with a diameter commonly less than 0.5 cm. and rarely exceeding 1 cm. They were often single, but rather more often multiple; when multiple there were usually only two or three and these were discrete in most cases, but occasionally they were numerous and aggregated. Most often the papillomas were found in gallbladders which were otherwise normal or presented only slight microscopic signs of disease, but they sometimes occurred also in association with chronic catarrhal cholecystitis and with cholelithiasis, especially with single stones.

The cholecystographic manifestations in the cases without stones or other complication corresponded to the morbid anatomy and were as follows: Invariably the shadow defects produced by papillomas maintained

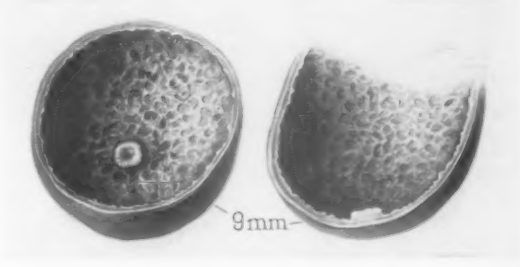


Fig. 2. Face and profile views of adenoma depicted in Figure 1.

the same relative situation on all films, even at reëxamination (Fig. 3). The defects were clear, oval or round and small, usually less than 0.5 cm. in diameter. They were never immediately at the pole of the fundus, and were often remote from it. In many cases the defects were marginal and then were especially suggestive of papillomas. As a rule, only one or two defects were visible but occasionally there were three or more. When multiple, the defects were well separated, never closely grouped. Usually the defects were most plainly visible at the twentieth hour when the gallbladder was contracted and partially emptied, and in many cases were seen only at this time (Fig. 3). Except for the rarefactions depicting the papillomas, the shadow of the gallbladder was of good density, often better than the average; this is perhaps explainable by the fact, established by Caylor and Bollman, that gallbladders with hypertrophic rugae, which are frequently associated with papillomas, produce the greatest concentration of bile.

a *b* *c*

FIG. 3. Multiple shadow defects representing papillomas. Although the defects are apparent at the sixteenth hour (*a*), they are more clearly depicted at the twentieth hour (*b*); *c*, gallbladder laid open to show papillomas in situ.

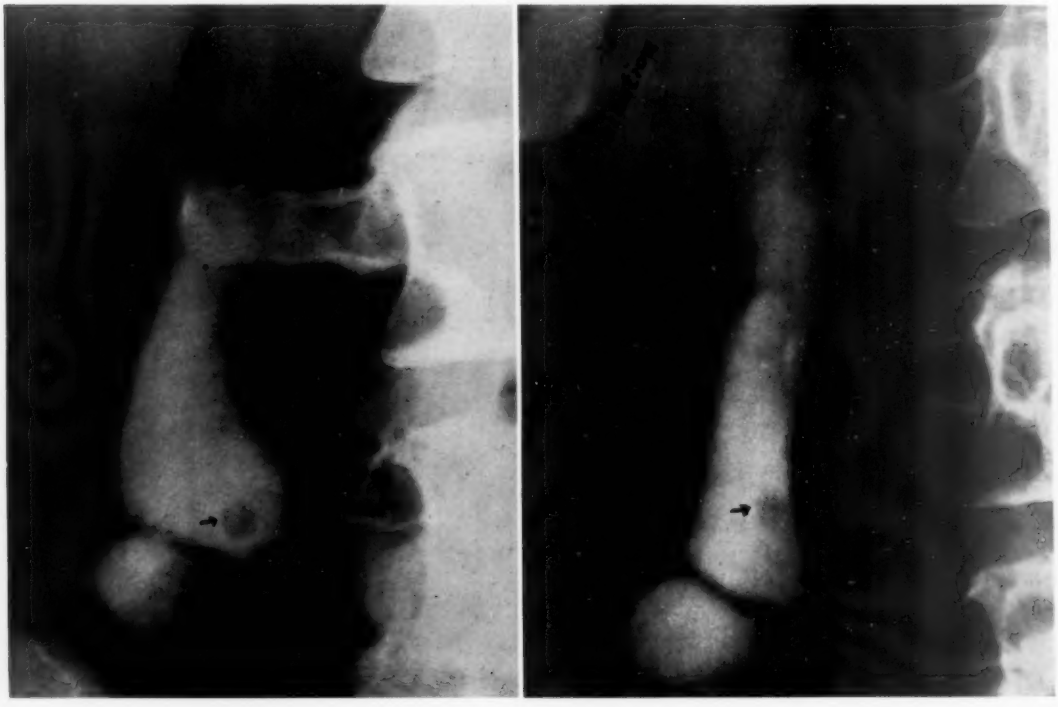


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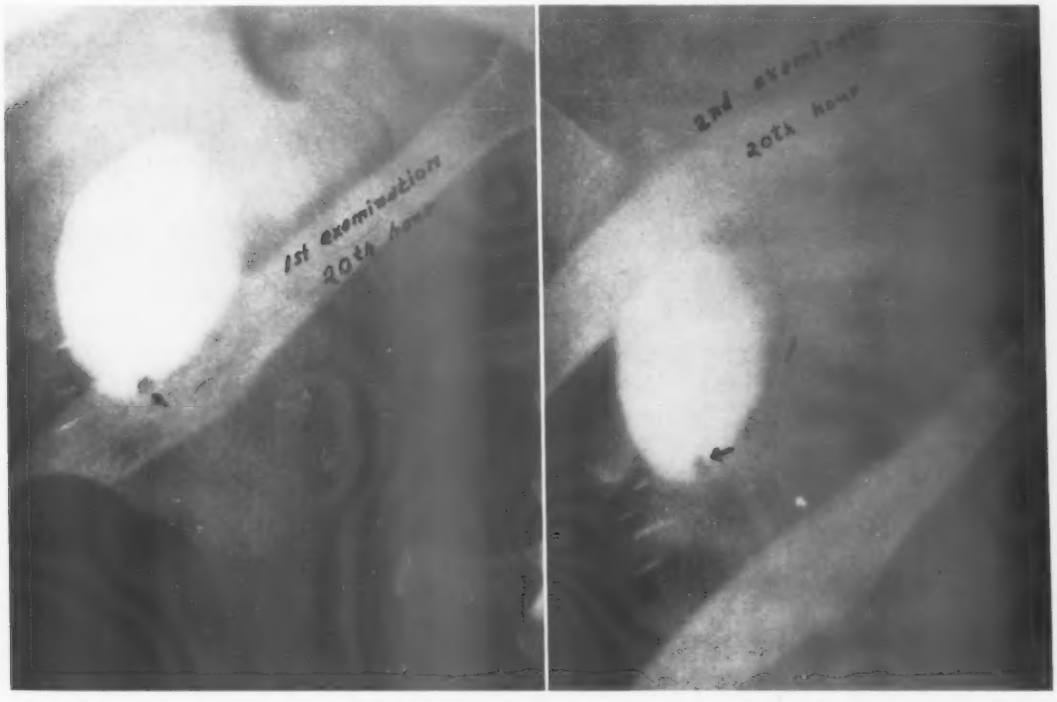
FIG. 4. *a*, Shadow-defect produced by a cholesterin stone; *b*, change of position at the second examination.

On the basis of these characteristics I have made a diagnosis of papilloma in 51 cases. Thus far 15 of the patients have been operated on, not merely on the ground of the roentgenologic diagnosis, but because the clinical features warranted intervention. In 14 cases the diagnosis was confirmed. In one case, only small cholesterin stones were found.

It is obvious that many of the cholecystographic manifestations of papillomas may be imitated by those of small cholesterin gallstones. Nevertheless, gallstones usually change in situation (Fig. 4), tend to group closely as the gallbladder contracts, are usually facetted and angular in outline, often have a dense deposit of calcium on their surfaces, and are less clearly transradiant than papillomas. However, when papillomas are associated with transradiant calculi, efforts to distinguish one from the other are likely to be futile. Clear areas produced by gas in a loop of small bowel overlying the gallbladder may resemble those caused by papillomas, but the former usually shift about or disappear. On the whole, I feel that the signs of papillomas as described are based rationally on the pathology of these growths and will prove to be reliably diagnostic.

My former assistant, Dr. H. W. Hefke, recently reported a case of papilloma diagnosed by cholecystography and confirmed by operation. In addition to traits which I have described, he regards changes in the form of the shadow of the gallbladder as indicative of papillomatosis, and suggested that they may result from contractions of the mucosa or wall of the gallbladder. He also urged that pains be taken to secure, if possible, a tangential view to show the papilloma in relation to the wall of the gallbladder, and thus distinguish it from a gallstone, which always has a layer of medium between itself and the wall.

Encouraged by this experience with papillomas I have extended investigation to other benign tumors. In the five years



a *b*

Fig. 5. Shadow-defect at fundus visible only at the twentieth hour in both examinations. Adenoma.

from 1927 to 1931, inclusive, 71 proved cases of benign tumor of the gallbladder, other than papilloma, were encountered at the Clinic. They comprised one case of myxoma, one of fibroma, 8 cases of polyps of unstated character, and 61 of adenoma, including one cystadenoma. In all but 2 cases the adenomas were single and almost all of them were situated in the fundus. Most of them were hemispherical and projected convexly into the lumen. Their size varied from 2 mm. to 2.2 cm. with an average of 8 mm. The adenomas were associated with gallstones in 34 cases, with papillomas in 11, and with cholecystitis of varying degree in 44. Notwithstanding the high incidence of these complicating factors, it is notable that among 47 cases of adenoma examined cholecystographically the gallbladder was depicted by a dye shadow of normal density in 23 and by a faint shadow in 9. It is probable, therefore, that in many cases the growths produced corresponding visible transradiant areas, but until recently all such rarefactions were attributed to cholesterin stones. In the last few months, however, a diagnosis of benign tumor, as distinct from that of papilloma, has been offered in 10 cases. A specific diagnosis of adenoma was made in only one case although in view of the fact that, next to papillomas, adenomas are by far the most common variety of benign tumor this diagnosis would have been warranted. Three of these patients have been operated on and the diagnosis was confirmed in each.

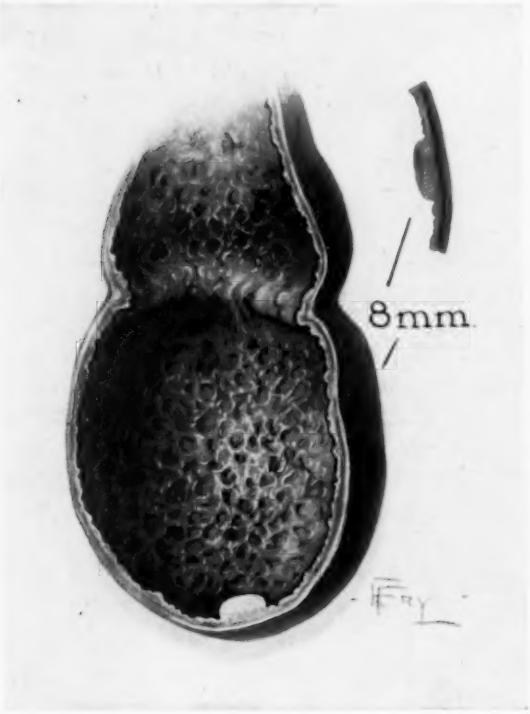


FIG. 6. Gallbladder shown in Figure 5 with profile view of adenoma at fundus.

In the first case, films at the fourteenth and sixteenth hours gave negative results; at the twentieth hour the tumor was depicted as a dome-shaped marginal defect, immediately at the pole of the fundus (Fig. 5). At operation an adenoma was found at this site (Fig. 6). Two defects appeared on all the films in the second case; one, near the lower margin of the shadow of the gallbladder was small and suggestive of a papilloma; the other defect, above the first, was almost 1 cm. in diameter and was attributed to a benign tumor (Fig. 7). At operation a papilloma and an adenoma were found at the sites corresponding to the respective defects (Fig. 8). In the third case, a relatively large, rounded, hazy thinning of the shadow near the fundus was seen at the fourteenth and sixteenth hours; at the twentieth hour the rarefaction was much smaller, more clearly transradiant and crescentic in shape, and was considered to represent the apical portion of the tumor (Fig. 9) which at operation proved to be a cystadenoma (Fig. 10). All of the patients were reëxamined, and as defects recurred with the same appearance and situation artefacts could be excluded.

In arriving at the diagnosis the size, form, situation, transradiance and number of defects were considered in the light of the morbid anatomy of benign tumors, especially of adenomas. Except in number, all of these factors varied with the angle of roentgenography. Most typical, perhaps, was the first of the three cases. The defect

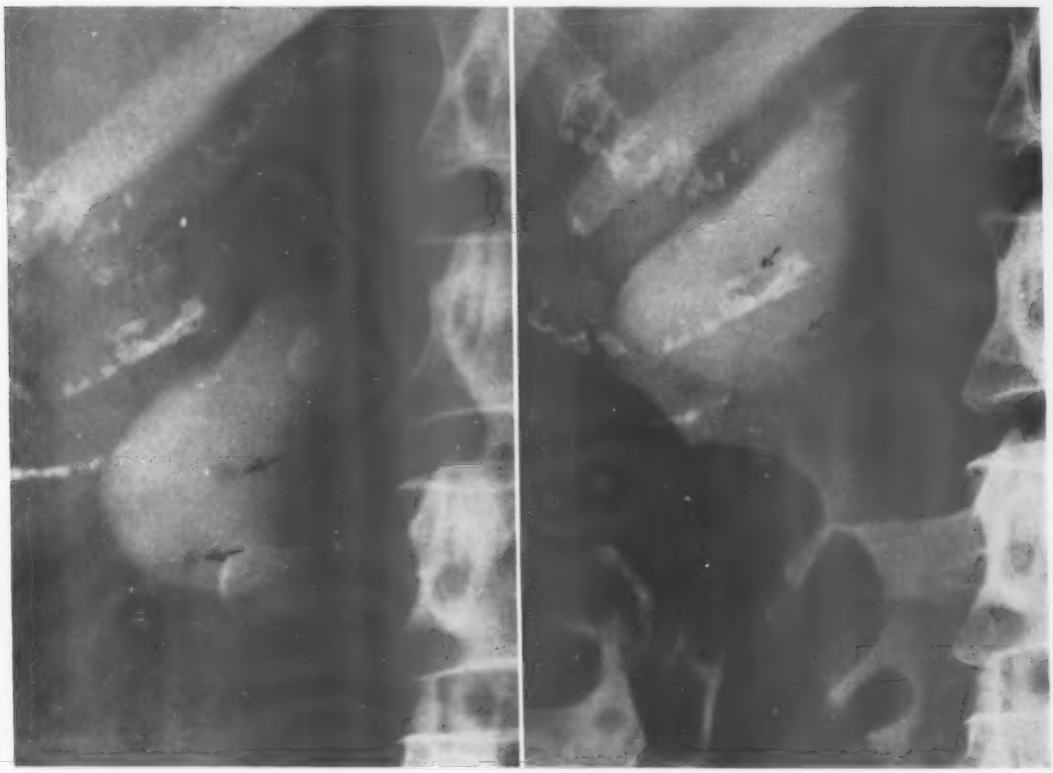


Fig. 7. Two shadow-defects, the larger one, above, representing an adenoma, the lower a papilloma.

was definitely larger than a papilloma of average size, semicircular or dome-like, situated directly at the pole of the fundus, clear and not accompanied by defects elsewhere (Fig. 5). This description also applies to the undiagnosed case of adenoma which first aroused my interest in the subject (Figs. 1 and 2). In both cases the roentgenographic angle at the twentieth hour was evidently tangential to the tip of the fundus. The diagnosis in the second case was based chiefly on the size of the upper defect, for its situation was not typical (Fig. 7). In the third case the large, rounded, incompletely transradiant defect seen in the early films was suggestive of a tumor partially concealed by the dye (Fig. 9); evidently the roentgenographic axis was not tangential to the base of the tumor. Depiction of the curved apex of the growth in the final set of films aided diagnosis. I have noted similar defects in two other cases which remain to be proved.

Because they are small, adenomas are seen to best advantage and often are visible only at the twentieth hour when the gallbladder is well contracted. Distinction from cholesterin stones and papillomas may be difficult. However, as I have stated,

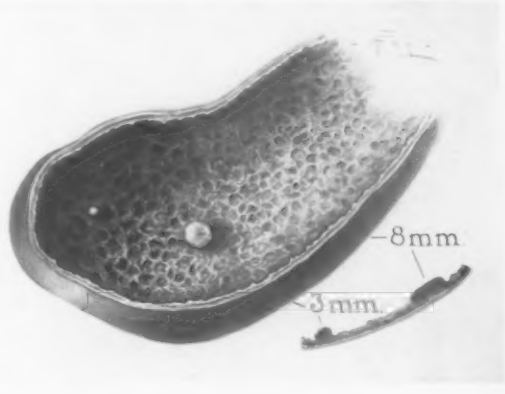


Fig. 8. Gallbladder depicted in Figure 7. The larger of the tumors shown was an adenoma, the smaller a papilloma.

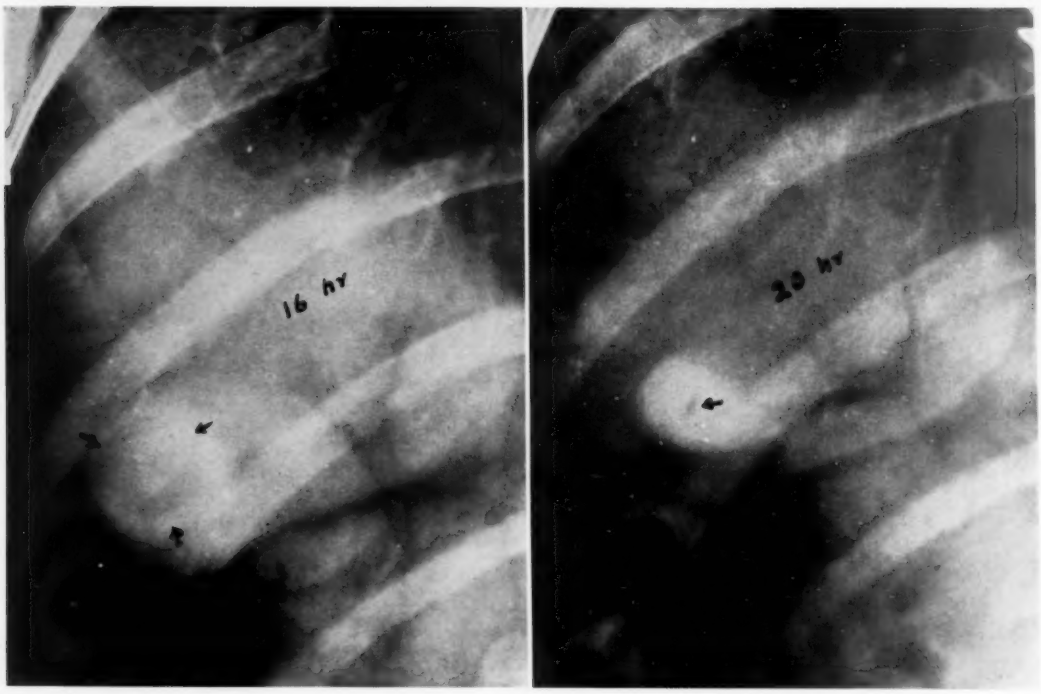


FIG. 9. *a*, Hazy defect near fundus at sixteenth hour; *b*, at the twentieth hour the defect is smaller and crescent shaped. Cystadenoma.

gallstones are usually multiple and grouped; papillomas are more frequently multiple than adenomas, commonly smaller, pedunculated rather than sessile, and seldom are situated directly at the fundus.

Sarcomas of the gallbladder are so unusual that Kaufmann was able to find only 13 cases on record. Histologically the sarcomas were mostly of the spindle-cell variety, and in 10 cases they were associated with gallstones. They were twice as common among women as among men, and the age of the patients varied from forty-five to sixty-eight years. Recently a woman, aged fifty-five years, with primary sarcoma was observed by Brunschwig. Intravenous injection of tetiothalein sodium failed to produce a shadow of the gallbladder. Operation disclosed a large tumor which had originated in the right lateral wall of the gallbladder, and which on microscopic examination proved to be a spindle-cell sarcoma. The gallbladder was enormously dilated and contained 50 c.c. of clear fluid. A single proved case of lymphosarcoma has been seen at The Mayo Clinic, but this was before the advent of cholecystography.

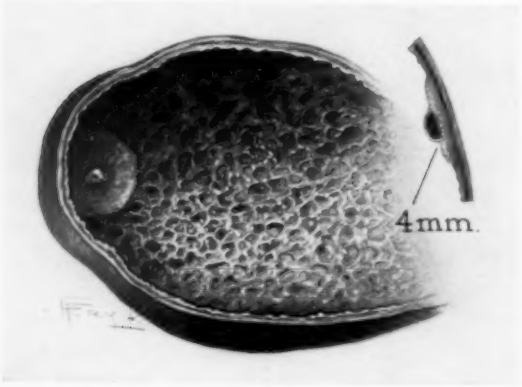


FIG. 10. Gallbladder with face and profile views of the cystadenoma shown in Figure 9.

It is freely accepted that primary carcinoma of the gallbladder affects women chiefly, and statistics derived from operations and necropsies indicate that from 75 to 90 per cent of the cases are found among

women. Like carcinoma elsewhere it occurs principally in the later decades of life. Especially notable is the common association of gallstones with carcinoma. Among more than 200 cases of primary carcinoma of the gallbladder in which operation was performed at the Clinic, gallstones were found in 65 per cent and percentages from necropsy elsewhere range considerably higher. Carcinoma often begins in the neck of the gallbladder, but it may arise in the fundus (Kaufmann). Depending on its variety, whether scirrhous, medullary, or mucoid, the growth may infiltrate the wall of the gallbladder or project into the lumen as a frank nodule. As a rule, the luminal aspect of the growth is ulcerated. Often the gallbladder is enlarged and filled with pus and serum; rarely it is contracted. Frequently the growth invades the right lobe of the liver, and metastasis to the liver may occur. Extension to the duodenum or transverse portion of the colon with resulting stenosis or perforation of the bowel is not uncommon.

From the standpoint of morbid anatomy, the similarity of carcinoma of the gallbladder to gastric carcinoma is striking. It is reasonable to expect, therefore, that on examination with opaque mediums the roentgenologic manifestations of carcinoma of the gallbladder will be entirely comparable to those of gastric carcinoma. Unfortunately, however, visualization of the gallbladder by cholecystography requires not only that the cystic neck be sufficiently patent to permit the inflow of bile, but that the function of concentrating the bile be preserved to a considerable degree. Since carcinoma apparently has a predilection for the cystic inlet, obstruction is to be anticipated in most cases, and it may occur early. Further, when the growth has invaded a large area of the wall of the gallbladder, as will have occurred in most cases at the time of examination, interference with concentration is inevitable. Hence the prospect of demonstrating carcinoma as a defect in the cholecystographic shadow is not brilliant. Roentgenoscopy, which is requisite for the revelation of early gastric carcinomas and other tumors, is difficult to apply to the gallbladder, for the latter is small, less amenable than the stomach to manipulation, and, at best, casts a shadow which is less distinct than that of the stomach.

At the Clinic in the five-year period from 1927 to 1931, sixty-one primary carcinomas of the gallbladder were found at operation. Only 16 of the patients had a cholecystographic examination. In one case the shadow of the gallbladder was of normal density and apparently free from defects, in one case normal function was likewise preserved, but multiple stones were exhibited, and in the remaining 14 cases no shadow of the gallbladder appeared, although gallstones were manifest in 7.

A similar experience with carcinoma is reported by Eisler. In 2 of his cases the shadow of the gallbladder was of normal size and form, but emptying was delayed, which Eisler attributed to impaired elasticity of the wall of the gallbladder. In 5 cases in which the duct was obstructed by the tumor the shadow was enlarged and did not diminish after egg yolk had been given. Although Eisler does not mention it, it seems possible that in some of these cases the shadow of the gallbladder was primary and not caused by dye. By far most common in the series was complete absence of a dye shadow, due to obstruction of the ducts. Stones were evident in many cases.

That the chance of demonstrating carcinoma is not utterly hopeless, however, is shown by a case reported by Taterka. The growth produced a relatively large, irregular defect along the outer wall of the gallbladder but not extending quite to the fundus. His illustration shows a slight incurvation of the wall opposite the growth which one might attribute to spasm. The entire picture is analogous to that of medullary carcinoma of the stomach as seen with the barium meal. Taterka does not say that a cholecystographic diagnosis was made in this case, but, in retrospect, the manifestations seem to be pathognomonic.

Although the material here presented is too small to warrant absolutely positive deductions, it would appear that in cases uncomplicated by gallstones it is possible in many instances not only to demonstrate but also to diagnose papillomas and adenomas. The outlook for revealing and identifying carcinoma is not good, but Taterka's case indicates that this is at least occasionally feasible, and when the examiner observes a defect with a diameter of more than 2 cm. and an irregular internal border he should not fail to take carcinoma into consideration. Such instances are more likely to be met in the course of cholecystography as a routine regardless of the clinical history, for after the development of marked symptoms the carcinomatous gallbladder will almost never be visualized with the dye.

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THE VALUE OF THE ROENTGEN RAY IN THE DIAGNOSIS OF RENAL TUBERCULOSIS*

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THE importance of the roentgen examination in urologic problems has become increasingly more valuable by epoch-making improvements in apparatus and technique until now the evidence adduced from the roentgen study of the kidneys is the most valuable in the entire urologic domain. However, it was not until the introduction of the movable grid diaphragm through the brilliant efforts of Dr. Hollis E. Potter that accurate roentgen diagnostic criteria were possible. Before this accomplishment it was only possible to diagnose that type of renal tuberculosis of long standing in which calcification had taken place in the areas of cortical necrosis. In some cases this calcification involves the entire kidney and has been generally referred to as autonephrectomy (Figs. 1, 2 and 3).

DEFINITION

Tuberculosis of the kidney is a slow, chronic disease with very obscure symptoms, but with the occurrence of marked pathological processes before the advent of symptoms.

INCIDENCE OF TUBERCULOSIS

The late B. A. Thomas[1] in 1930, in this same Academy stated that autopsies of individuals with either active or quiescent tuberculosis showed that approximately 10 per cent have involvement of the genito-urinary tract. In his series of general urological cases, tuberculosis of some part of the urogenital tract was about 2 per cent, but only 0.5 per cent was genital, leaving 1.5 per cent limited to the kidneys. He further found that it is recognized more often in the third, fourth and fifth decades of life and that males were affected about four times as frequently as females, that the right kidney was involved about three times as frequently as the left and that in a considerable number of cases the disease had become bilateral at the time surgical treatment was sought.

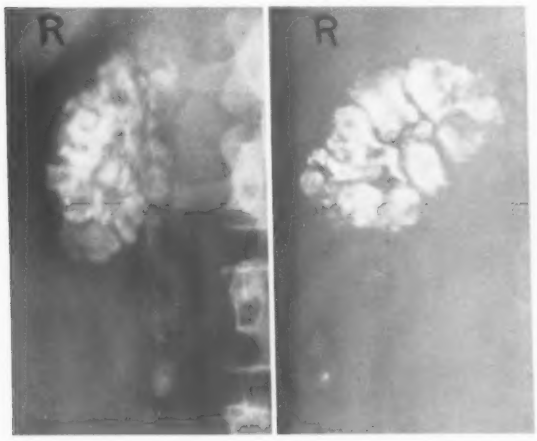

FIG. 1. Complete autonephrectomy before and after removal.

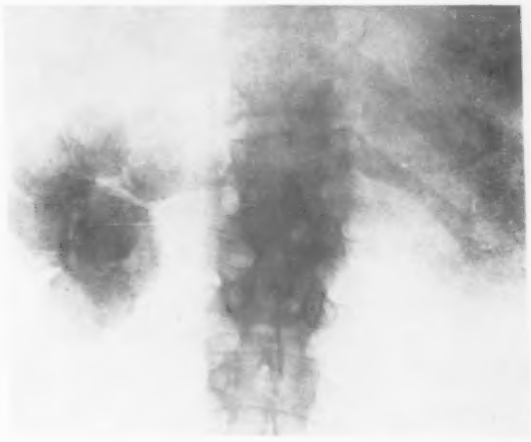

FIG. 2. Complete autonephrectomy. Old tuberculosis of the first and second lumbar vertebrae.

* Read before the New York Roentgen Society, New York Academy of Medicine, New York City, November 16, 1931.

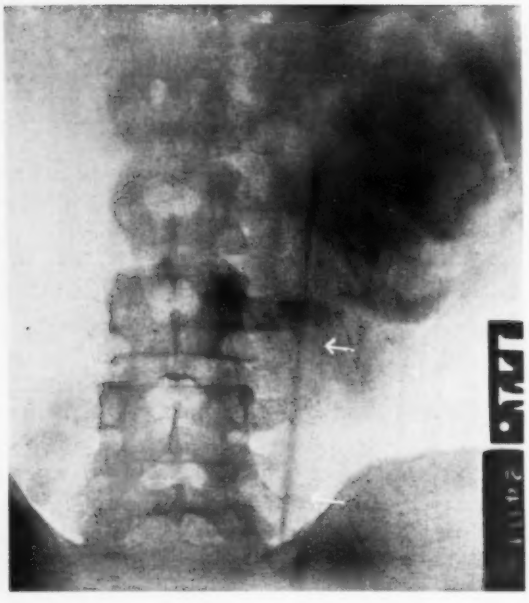

FIG. 3. Incomplete autonephrectomy with involvement of the ureter which is transformed into a dense fibrous cord.

MODE OF INFECTION

A proper appreciation of the roentgen findings is dependent upon a thorough knowledge of the pathological processes of this disease. Much has been written as to the mode of infection and a variety of opinions has been expressed, but it is now almost universally agreed by pathologists that it is of hematogenous origin. Its renal localization is never primary, but, on the other hand, is secondary to tuberculosis elsewhere in the body.

Urologists likewise almost universally agree that tuberculosis of the kidney never results from an ascending infection from the ureter or bladder, although it is theoretically possible that such an infection might occur through either the lymphatic (lymphogenous) or through the lumen of the ureter (urogenous) during ureteral reflex.

Tuberculosis of the genital organs is also of hematogenous origin and has its source in a focus in either the respiratory or gastrointestinal tract, or may very occasionally occur as the result of coitus. It is still very doubtful whether tuberculosis of the kidney ever results in direct extension from a tuberculous focus in any of these organs.

PATHOLOGY

Tuberculosis of the kidney always begins in the cortex of the kidney. The tubercle bacilli reach the blood stream through the respiratory or alimentary tract, though occasionally through the tonsils and glands of the neck. In the vast majority of cases of renal tuberculosis the original focus of infection is quiescent and often times not suspected.

Benda,[2] in 1903, propounded the theory that the tubercle bacilli are carried by the blood stream and become lodged as emboli in the glomerular capillaries with the formation of a tubercle (Fig. 4).

Doubtless tubercles may be formed by bacilli lodging in other capillaries and, according to MacCallum,[3] due to their growth and conglomeration they soon extend in a direction parallel with that of the collecting tubules to form the so-called white lines of the kidney reaching from the cortex to the pyramid.

Aschoff[4] believes that tubercles are also

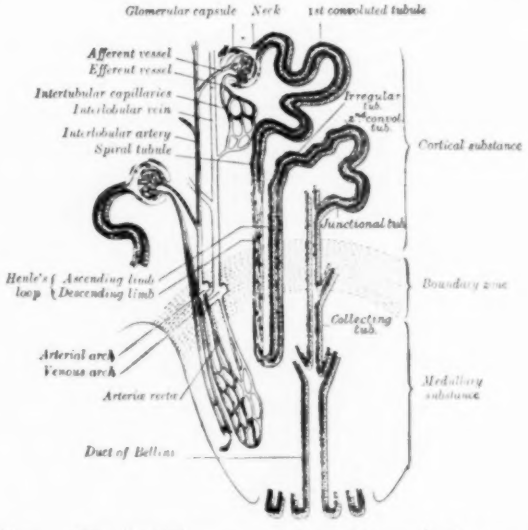

FIG. 4. The bacilli pursue a course through the renal artery into the arterial arch, interlobular artery and afferent vessel of the glomerulus where they form emboli with subsequent tubercles or, in some cases, escape through the capsule into the tubule and form tubercles at some point along its course. (From Gray's Anatomy, twentieth edition.)

formed by bacilli lodging in the tubules in the course of urinary excretion and that this may explain those cases of more extensive caseous necrotic areas which are so frequently encountered, as shown in Figures 1, 2 and 3.

The tubercle bacilli often pass through the glomerular capillaries into the glomular capsules (Bowman's capsule) which consists of a basement membrane lined on its inner surface by a layer of epithelial cells. If the tubercle bacillus passes this point it is then possible for it to travel through the entire uriniferous tubule before becoming arrested.

Theoretically it would appear that it is possible for a few bacilli to pass through the entire uriniferous tubular system and enter the pelvis without producing a lesion in the cortex, but this point has never been proved.

At the point where the tubercle bacilli become arrested the tubercle is formed. As elsewhere, tubercle formation consists in the development of small, roughly concentric masses of epithelioid cells clustered around a central area which often contains a giant cell, in the marginal portion of which mononuclear cells of the lymphoid type are frequently seen. The bacilli may be observed in either the protoplasm of the giant cell or in the crevices between the epithelioid cells. Tubercles are characteristically avascular, a circumstance which may be conducive to tissue necrosis. Coalescence of tubercles is the rule with caseation of the central portion and with extension of the margins until a large portion of kidney tissue is destroyed, including one or more papillae, with erosion and ulceration into a calyx. When this erosion and ulceration into the calyx occurs the irritating material is poured into the calyces and pelvis (Fig. 5). An acute irritation is set up in the kidney to be followed by an extension downward into the ureter and bladder. It is not until this stage of the disease that the train of symptoms of frequency, dysuria, pyuria and hematuria occurs. Therefore, it is evident that these symptoms, which may not be present to a marked degree, should always warrant a careful urological survey.

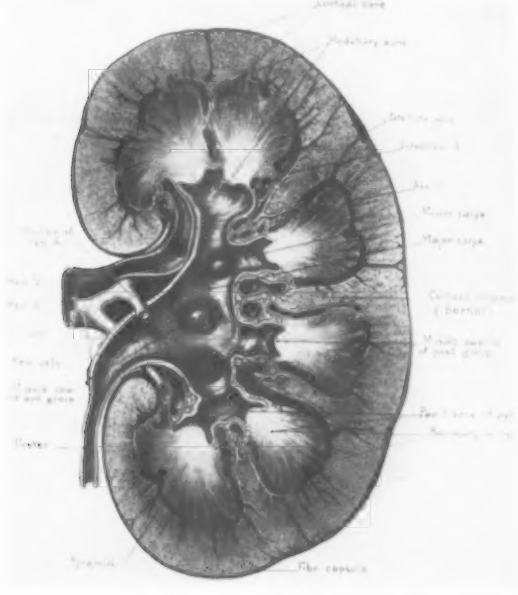

Fig. 5. Beautifully illustrates the anatomy of the kidney. Cortex and medulla differentiated. The basis upon which "fringing" occurs with involvement of the papillae is here perfectly explained. (From Kelly and Burnam's Diseases of the Kidneys, Ureters and Bladder. Drawing by Broedel.)

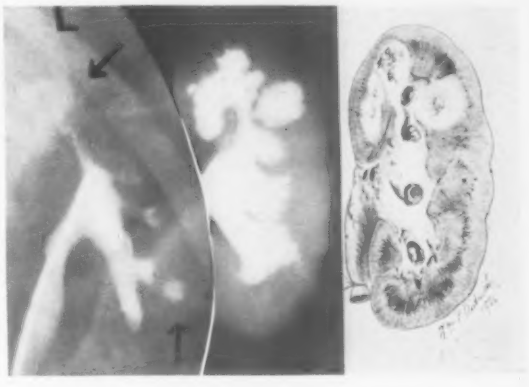

Fig. 6. Typical erosion of upper calyx and fibrosis of infundibulum leading to it. Calcification in lower pole indicated by arrow is in the cortex, but not showing in the drawing and nearly obscured in the injected kidney. No characteristic "fringing" of upper calyx. Tubercle bacilli found in direct smear. Positive guinea pig inoculation. Left nephrectomy. Diagnosis confirmed.

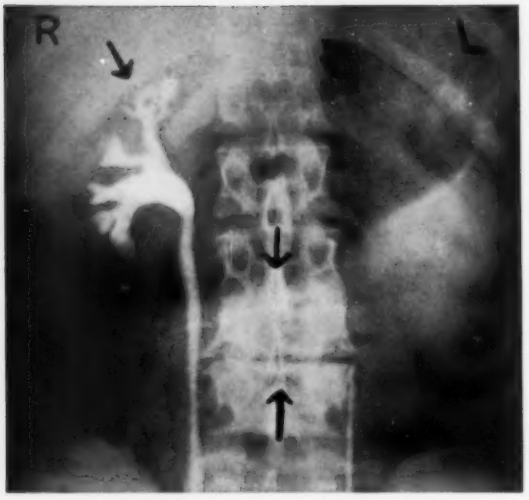

FIG. 7. Characteristic erosion of upper calyx. Remainder of kidney normal. Ureter not involved. Old tuberculous spine. Tubercle bacilli found in direct smear. Right nephrectomy. Diagnosis confirmed.

Very exceptionally inspissation of the necrotic material with fibrosis and calcification may occur without rupture into the pelvis; such cases are usually discovered in the course of examination for some other condition. Infrequently extension towards the capsule may occur with resultant perinephric abscess formation and subsequent development of a sinus.

TYPES OF TUBERCULOSIS OF THE KIDNEY

Tuberculous nephritis, also described as amyloid disease, and miliary tuberculosis are obviously not surgical forms of tuberculosis and the roentgen ray offers no aid in their study. The roentgen ray is of value only in the surgical forms which consist of ulcerative tuberculous papillitis, tuberculous pyelitis, tuberculous pyonephrosis, perirenal tuberculous abscess and that type in which extensive fibrosis and calcification occur producing a permanently functionless kidney—a condition known as autonephrectomy.

ROENTGEN EXAMINATION IN RENAL TUBERCULOSIS

The roentgen examination can be divided into two distinct methods. The first is that in which only the plain film is used. The information obtained by this method consists in the detection of irregular areas of calcification of varying density located in that part of the kidney which represents the cortex, and for that reason it is very desirable that the films be of such quality that both kidney outlines are distinctly discernible. Not infrequently, calcified tuberculous areas and calculi occur in the same kidney. While the positive identification of these shadows is not possible in the plain film, a differentiation between a true calculus and a tuberculous calcification can often be made by the fact that stones occur only in the pelvis and calyces, lie more medially and often assume the shape of the pelvis or calyx in which they lie, while the tuberculous calcification is usually much more irregular and closer to the capsule, as shown in Figure 6. The lower arrow in this illustration points to the calcification in the cortex, while the upper arrow points to the eroded calyx. In perinephric abscess the information obtained in the plain film has been very unreliable.

The second method is the use of pyelog-

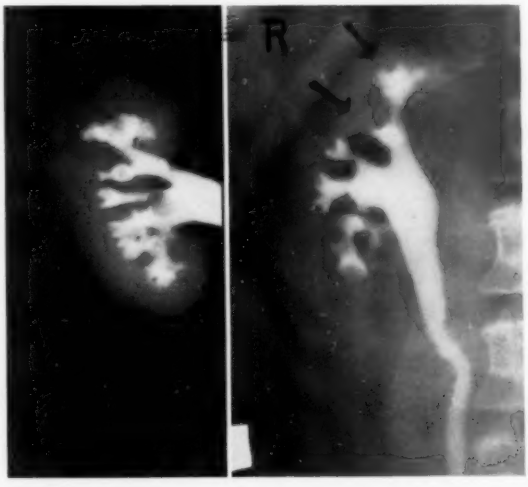

FIG. 8. Retrograde pyelogram showing the characteristic "fringing" of the upper calyces. Injected specimen reveals the eroded outer margins of the upper calyces while the irregular lower calyces are due to overdistention from the injection with extravasation into the cortical substance. Tubercle bacilli found in direct smear. Right nephrectomy.

raphy. The earliest recognizable roentgen finding in renal tuberculosis is the alteration in the outer margin of a minor calyx. The involvement of the tip of the papilla which lies in the cup of the calyx (see Fig. 5) produces the characteristic "fringing" of the outer margin of the calyx, such "fringing" never occurring until the tuberculous ulceration has extended into the papillae and eroded into the calyces (Fig. 7). This "fringing" of the calyces is characteristic of tuberculosis (Figs. 8 and 9); it is entirely different from the findings in the kidney as the result of tumor, hydronephrosis or polycystic disease. The number of calyces involved is dependent upon the extent of the disease.

If the disease is not recognized the pelvis becomes involved, further ulceration occurs and fibrosis and strictures appear in the calyces with the production of a pyonephrosis. The roentgen appearance of a tuberculous pyonephrosis differs considerably from that of an ordinary pyonephrosis to the extent that some of the calyces will usually present definite signs of "fringing" (Fig. 11).

Still later in the disease the constant irritation of the ureteral mucosa produces a thickening and fibrosis with alternating areas of dilatation and narrowing as a result of strictures, which so frequently occur in this disease (Fig. 12).

Fig. 9. Double pyelogram with thorotrast. Typical "fringing" of lower calyces. Tubercle bacilli found in direct smear. No operation to date.

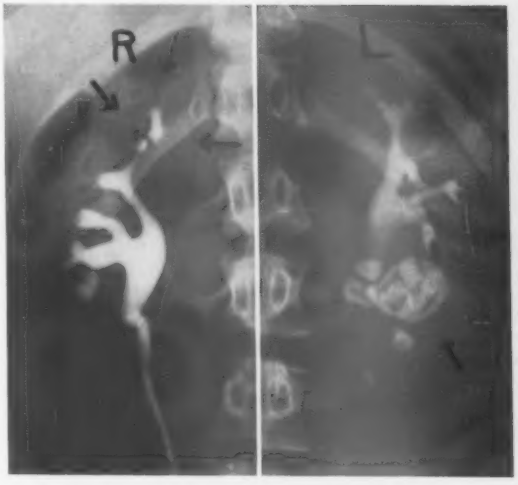

Fig. 10. Tuberculous ulceration upper pole, right kidney. Smear positive for tubercle bacilli. Guinea pig inoculation positive. Right nephrectomy. Diagnosis confirmed. Left kidney normal. Note calcified lymph nodes.

The bladder, which produces the fewest roentgen findings and is the last organ involved, is, however, responsible for the earliest symptomatology. In advanced cases the bladder may be so irritable and contracted that ureteral catheterization is impossible and a cystogram is necessary to reveal the true condition.

In studying renal tuberculosis by means of the roentgen ray there are two complications which often arise and which must be constantly borne in mind in arriving at the correct interpretation of the roentgen findings, namely, severe renal, ureteral or bladder spasm which occasionally is so severe that ureteral catheterization is impossible; but in our experience a rest of a few days will invariably allow this procedure to be carried out. The other complication is a recent renal hematuria. If a kidney has recently bled, a clot occasionally forms and will produce irregularities in the calyces and even complicate the picture by producing a so-called filling defect. Therefore, one should know whether or not there has

been a recent hematuria. It has always been admitted that spasm is a common finding in tuberculosis and for that reason pyelographic studies have been more or less uncertain. In our clinic, however, it has been our custom to repeat the roentgen study until satisfactory pyelograms are obtained and it is hardly ever that the second attempt does not yield satisfactory films. When one compares the percentages of positive findings from pyelographic studies with the results obtained in staining the bacilli in direct smears it can be readily seen how important it is to have the correct diagnosis without waiting three to eight weeks to obtain the results of guinea pig inoculation.

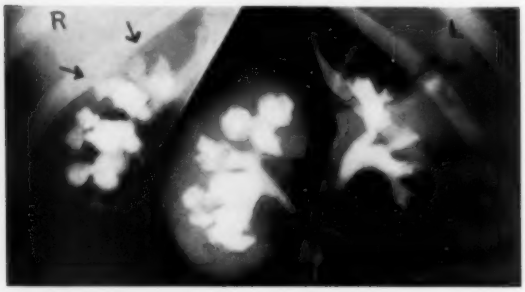

Fig. 11. Tuberculous pyonephrosis. Note fine "fringing" of minor calyces of upper pole. Injected specimen after removal. Normal left kidney.

Overdistention of the renal pelvis and calyces occasionally produces extravasation into the cortex and may be confused with the "fringy" appearance due to tuberculosis. However, this seldom occurs unless the injection is done by syringe instead of by the gravity method.

With the advent of intravenous urography it was hoped that its greatest results might be in the early recognition of renal tuberculosis and it probably will be in time. Up to the present, however, the results have been disappointing, chiefly owing to the fact that sufficient concentration of the dye in so many cases is lacking. However, before the introduction of uroselectan B in Europe, and neo-iopax in this country, my results with intravenous urography had been most unsatisfactory, but with the introduction of these new solutions our films and results have improved in diagnostic quality and I believe that greater advances will be made in the future.

A STATISTICAL ROENTGEN SURVEY OF 35 CASES OF RENAL TUBERCULOSIS

10 cases had only plain films
- 6 of these were negative
- 2 revealed tuberculous calcification
- 2 revealed autonephrectomies
- 40 per cent positive diagnosis

23 cases had pyelograms
- 4 cases unsuccessful
- 3 cases diagnosed as normal
- 16 cases gave positive roentgen evidence of tuberculosis
- 70 per cent diagnostic accuracy

2 cases had cystograms
- 1 showed a contracted bladder
- 1 showed contracted bladder with regurgitation into the ureter.

It would appear from these statistics that correct information is obtainable from complete roentgen studies in 70 per cent of the cases.

In a series of 55 cases of renal tuberculosis, the organism was found in direct smear in 30 cases, or 55 per cent. In the remaining 25 cases, in which the organism could not be found in direct smear, the guinea pig inoculations were positive. In our experience to date the results of culturing the tubercle bacilli have been none

Fig. 12. Erosion of minor calyces indicated by arrows. Strictures of the infundibula and ureter.

too successful. In several instances, in which guinea pig inoculations were positive, the cultures, on the other hand, failed to reveal tubercle bacilli.

It is our feeling that the guinea pig inoculation will always reveal positive results, provided the pathological lesion has progressed to the point of erosion of the pelvis or a calyx, while if the tuberculous ulceration has not progressed to this stage, the patient is symptom-free.

CONCLUSIONS

1. No urological investigation for renal tuberculosis is complete without satisfactory plain films and pyelograms of the urinary tract.

2. The early roentgen findings in renal tuberculosis are "fringing" of the calyces and possibly calcification in areas of cortical necrosis.

3. Our statistics show a diagnostic accuracy of 70 per cent in the pyelographic series. On the other hand, 40 per cent of the cases of known renal tuberculosis showed areas of cortical calcification in the plain film. While the direct smear yielded only 55 per cent diagnostic accuracy, the guinea pig inoculations yielded positive evidence in the other 45 per cent.

4. There are no contraindications to pyelography in renal tuberculosis.

5. Intravenous urography has so far not yielded the brilliant results hoped for, but with improvement in the injection material and technique it is possible that great diagnostic accuracy may be evolved.

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PYLORIC STENOSIS WITH HYPERTROPHY OF THE PYLORIC MUSCLE IN THE ADULT*

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HYPERTROPHIC pyloric stenosis occurs in the adult and is found to be the cause of symptoms simulating those of carcinoma or ulcer of the pylorus. While this condition is rare, it occurs frequently enough to give it an important place in the consideration and diagnosis of every case of pyloric obstruction.

In hypertrophic pyloric stenosis, there is a narrowing of the lumen of the pyloric canal, associated with hypertrophy of the wall of the pylorus. All the layers may be involved, but the muscularis and the submucosa are usually most affected. In some cases, there is marked narrowing of the lumen of the pylorus with little hypertrophy of the wall. In the literature, we find this condition called by many different names, all more or less descriptive of the pylorus found in the case or cases reported by the author. This condition is a very definite and distinct entity and some specific term should be adopted to include all cases with or without hypertrophy, so that it would not be confused with pyloric obstruction due to other causes. The term "idiopathic pyloric stenosis" has been used and is perhaps as suitable a term as any.

Osler pointed out that Hezekiah Beardsley, of New Haven, Connecticut, was the first to recognize hypertrophic pyloric stenosis. In 1788, Beardsley reported his observations in a case of a child whom he had observed from the age of two to five, when death occurred. Autopsy revealed hypertrophic pyloric stenosis. Tilger states that Cruveilhier was the first to recognize this condition in the adult and quotes his report of a case published in 1835, concerning a woman seventy-two years of age who died of incessant vomiting. The autopsy revealed hypertrophic pyloric stenosis. Tilger mentions that Andral recognized this condition at about the same time, and in 1837 published his experience with it. Maier, in 1885, made one of the most important contributions to this subject. He describes the anatomical and pathological findings in 31 cases coming to autopsy. Of these, 25 were males and 5, females, He is of the opinion that all these cases are congenital. Tilger, in 1893, reviewed the German, French and English literature and wrote a very comprehensive article on pyloric stenosis, in which he reports one case of his own and quotes the reports of 23 others proved by autopsy. The average age of these patients was forty-three. Maylard seems to have had the greatest number of these cases come under his personal observation. In two publications, appearing in 1904 and 1908, he describes his experience with 19 cases. He preferred gastroenterostomy and used it in each case. Most of these had simple stenosis without hypertrophy. There were 2 males and 17 females. More recently, Archer, Bastianelli, Bianchetti, Chaney, Crohn and Morton have published case reports and their observations on this condition.

It is the consensus of opinion that the reported cases represent a very small percentage of the actual number occurring.

The etiology of hypertrophic pyloric stenosis in the adult is not definitely known. It is generally accepted that it is of congenital origin and, although the anatomical abnormality is present at the pylorus, active symptoms do not appear until about middle life.

Examination of the pylorus reveals the presence of an indurated area or tumor mass encircling it. This tumor is sometimes the shape and size of a large olive. It is freely mobile, hard and resistant to pressure, and sharply defined in its limits on the

* Read at the Thirty-second Annual Meeting, American Roentgen Ray Society, Atlantic City, N. J., Sept. 22–25, 1931.

gastric and duodenal side of the pylorus. The examining finger cannot be introduced into the pylorus. The peritoneal covering is normal in appearance. On section of the pylorus, the lumen of the canal is found to be narrowed, sometimes to the point of occlusion. There is little change in the mucosa; it may be atrophied or hypertrophied. The submucosa is often the site of a marked hypertrophy. The muscularis is increased in thickness and usually shows the greatest amount of hypertrophy. The peritoneal coat is rarely affected. Round-cell infiltration, associated with the hypertrophy of the normal structures, is occasionally found. This has led some to call this condition "pyloritis." The principal finding in all cases is hypertrophy of the normal tissue layers with no evidence of malignant change.

The symptoms of pyloric stenosis vary with the degree of obstruction. In the moderate type, the symptoms are vague, indefinite and not characteristic of any particular lesion, often simulating those of ulcer. The patient complains of a chronic digestive disturbance which is not relieved by medication or diet. The appetite is poor. The patient is easily satisfied with a small amount of food and quickly develops a sense of fullness after meals. There is usually gastric distress and sometimes pain. Evidence of gastric retention is often present and becomes more pronounced in the later stages. Vomiting is a common and prominent symptom. Constipation is the rule and is very marked in the advanced case. Weight loss is usual and at times is very marked. In a case reported by Chaney, there was a weight loss of 109 pounds in ten months. In one of my cases, there was a 40-pound weight loss in four months. Dehydration and secondary anemia appear as the condition progresses. Tetany has been reported. The analysis of the gastric content does not give any typical findings. In some, the free hydrochloric acid is absent and lactic acid is present.

All symptoms become more severe as the obstruction increases. In the advanced stage, the symptoms are so pronounced that malignancy is usually suspected.

The diagnosis of hypertrophic pyloric stenosis in the adult is difficult and is seldom made before operation. One of the most valuable procedures in the diagnosis

Fig. 1. Case 1. Roentgenogram of stomach before operation showing wide pyloric sulcus, elongation of pyloric canal, poor filling of the duodenum due to pyloric obstruction. (Roentgen examination subsequent to operation showed resection of the stomach and anastomosis between stomach and upper jejunum functioning well.)

is the roentgen examination of the gastrointestinal tract. The roentgen findings reveal the presence of pyloric obstruction and gastric retention and in some cases will be sufficiently characteristic to establish the diagnosis. The findings which indicate hypertrophic pyloric stenosis are:

1. Concentric and elongated pyloric canal.

2. Widening of the pyloric sulcus (space between the stomach and duodenum).

3. Constant, unchanging appearance of the pylorus, which is not affected by manipulation or medication.

The most characteristic finding is the

concentric and elongated pyloric canal. Archer has already emphasized the importance of this sign. If the roentgen evidence shows that the pyloric canal is concentric

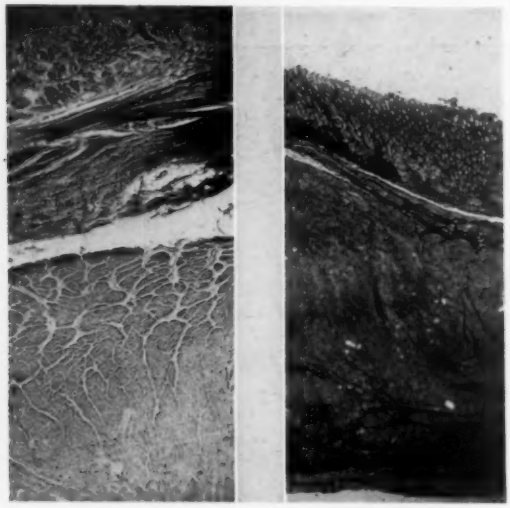

FIG. 2. Case 1. Comparison of thickness of section of normal pylorus and section in this case. Section on left: Through pylorus in case reported. Section on right: Through normal pylorus of patient about same age.

and elongated, that the pyloric sulcus is widened, and there is no evidence of other pathological process involving the stomach or duodenum, the presence of hypertrophic pyloric stenosis is indicated. The diagnosis cannot be made on the roentgen evidence alone. It is possible only after consideration and evaluation of the history, symptoms and roentgen evidence. The final diagnosis will usually be made at operation and in some cases not before histological study of a section of the pylorus. The roentgen findings give little help when the pyloric obstruction is complete, except to show that the pathological process is limited to the pylorus.

For permanent relief of symptoms, the treatment is surgical. Gastroenterostomy was favored by the earlier surgeons but more recently some type of plastic operation on the pylorus has been used and is now the method of choice.

CASE REPORTS

CASE 1. White, male, aged forty. Admitted to St. Alexis Hospital November 12, 1929.

Chief Complaint. Loss of appetite, pain in epigastrium, sour eructations, loss of weight.

Present Illness. Patient has had pain and abdominal distress for ten or eleven years; more severe during the last two or three years. The pain is dull and steady and is made worse by ingestion of food, particularly meats. Appetite is poor; quickly satisfied with small amount of food. Bowels constipated. Patient has protruding hemorrhoids, which bleed occasionally. Has had tarry stools frequently. Frequent urination for several years. Has lost about 28 pounds during the last ten years. Weighs 112 pounds at present.

Past History. Specific urethritis several years ago. Diphtheria at the age of five. No other serious illness or disease.

Physical Examination. Blood pressure 140/90. Protruding hemorrhoids and urethral stricture. Moderate pallor. Otherwise, physical examination is essentially negative.

Laboratory Examination. Blood count: red blood cells, 3,700,000; white blood cells, 9,000; hemoglobin, 80 per cent. Urine negative. Gastric analysis by fractional method shows free HCl and total acidity within normal limits.

Roentgen Examination. The entire gastrointestinal tract was examined by barium meal and barium enema. This examination showed that the pyloric sulcus was widened. The pyloric canal was concentric and elongated. There was marked delay before barium began to leave

FIG. 3. Case 1. Histological section through pylorus in case reported shows that the tumor mass is due principally to hypertrophy of the muscle fibers and round cell infiltration.

the stomach and then it passed out more slowly than normal. The stomach was hypotonic and there was intermittent hyperperistalsis. Some six-hour gastric retention. No evidence of other abnormality in the stomach. The rest of the gastrointestinal tract was normal (Fig. 1). *Conclusion.* Pathological process involving the pylorus, with obstruction and some six-hour gastric retention, the result of either a chronic ulcer or early malignancy.

Clinical and preoperative diagnosis based on above findings: Chronic gastric ulcer of the pylorus.

Operation. November 23, 1929.

Operative Findings. In the region of the pyloric ring, there was a smooth, spherical, freely movable tumor mass about one inch in diameter. No evidence of glandular involvement. Serosa not involved. Liver not involved. After removal, this tumor mass, upon section, appeared macroscopically to be hypertrophied pyloric muscle. About one-third of the stomach was removed and an anastomosis between the stomach and jejunum was made by the Polya method. Abdomen closed without drainage.

Pathological Report. Section of stomach.

Specimen consists of portion of the pyloric end of the stomach, measuring 7.5 cm. long. Involving the pylorus, there is an area more or less sharply circumscribed, firm and thick, measuring approximately 2×1.5×2 cm. This appears to be a continuation of the muscle wall. The remaining mucosal surface is of a pale pink, rather smooth appearance, showing marked atrophy of the usual folds.

Microscopic section reveals an intact atrophic mucous membrane. The supporting intervening stroma contains inflammatory cells consisting of round cells, occasional plasma cells and leucocytes. There is rather marked hypertrophy of the muscle wall involving both the inner circular and outer longitudinal layers. The loosely arranged connective tissue between the muscle bundles is infiltrated with a moderate number of inflammatory cells. No evidence of malignancy (Figs. 2 and 3).

Pathological diagnosis. Hypertrophy of pyloric musculature. Chronic gastritis.

Following operation, patient made an uneventful recovery. The diet was gradually increased until patient was on full house diet, four weeks after the operation.

On December 22, a roentgen examination was made, showing resection of the stomach (about the distal fourth has been removed), and the anatomosis with the jejunum. The remaining portion of the stomach is normal. Stomach empties a little slower than usual with an anastomosis, but there is no definite retention. Head of the barium column is in normal position at the end of six hours.

Fig. 4. Case 11. Roentgenogram of stomach before operation, showing marked dilatation, almost complete obstruction and almost complete forty-eight-hour gastric retention.

Patient was discharged from the hospital on December 24, 1929.

Final Diagnosis. Hypertrophy of the pyloric muscle, with pyloric stenosis and mild secondary anemia. Condition good. Prognosis good.

November, 1930: Since patient left the hospital, eleven months ago, there has been a gradual increase in weight and improvement in general health. Appetite is good and he states he can now eat anything and many things which he was not able to eat before. At present weighs 135, a gain of 27 pounds. Patient states he feels better than he has felt at any time during his adult life.

September, 1931: Patient states that he is feeling very well. His appetite is good. He can eat any kind of food; has no stomach trouble; does not vomit and bowels are regular. Weighs 122 pounds. This is less than he weighed in November, 1930, but he attributes his weight loss to hard work.

CASE II. White, male, aged fourteen. Entered St. John's Hospital October 2, 1930.

Chief Complaint. Nausea, vomiting, persistent constipation, lassitude and malaise, progressive emaciation.

FIG. 5. Case II. Roentgenogram after barium meal, six weeks after pyloroplasty, shows that the stomach is much smaller in size but somewhat larger than normal and is emptying well. No six-hour gastric retention.

Present Illness. Patient was well until four months ago, when he began to have gastrointestinal disturbance. At first, had pain after eating. Later, had vomiting attacks. The onset was sudden and the condition progressed rapidly so that the patient was soon unable to eat any solid food without vomiting. He could take liquids until about two weeks ago; since then, he has been unable to retain anything. Constipation slight at first, progressing until at present very marked. No bowel movement in last ten days. Patient has lost about 40 pounds in last four months. Weighs 98 pounds at present.

Past History. Usual childhood diseases. Otherwise, normal childhood. Patient has previously been a perfectly healthy individual. No vomiting attacks during infancy. Has always been a strong and well-nourished individual. There have been no symptoms referable to any system except the gastrointestinal tract. Appetite is poor. Habits of eating irregular. There has been marked nausea and vomiting and hematemesis. No constipation until four months ago. Family history is negative.

Physical Examination. Emaciated individual with pallor. Abdomen protrudes moderately Walls are thin. Tone is poor. No visible peristalsis. There is a large area of tympany, suggesting dilated stomach. There is a cleft palate. Otherwise, physical examination is negative.

Examination of blood shows: hemoglobin, 65 per cent; white blood cells, 6,200; red blood cells, 3,370,000; coagulation time, 1 minute; blood sugar, 76.8 mg. Urine, negative.

Roentgen examination on day of admission to the hospital, October 2. It was found that the stomach was filled with barium, evidently given at roentgen examination two days before admission. Stomach was several times larger than normal, with smooth contour and intermittent hyperperistalsis. There was a little barium scattered throughout the large intestine (Fig. 4). No barium passed out of the stomach during the roentgenoscopic examination. There was marked pyloric obstruction.

Patient was examined two days later, October 4, after several gastric lavages, and there was still a large amount of barium in the stomach. Examination two days later, October 6, after more lavage, showed that there was still considerable barium in the stomach.

Conclusion. Pyloric obstruction, with marked gastric retention and dilatation of the stomach. There was no evidence in this examination to indicate the exact nature of the obstruction. The causes suggested were: 1. Hypertrophy of the pyloric sphincter. 2. Malignancy.

Preoperative clinical diagnosis: Pyloric stenosis.

Operation October 6: When the abdomen was opened, examination revealed a firm tumor mass in the region of the pylorus about 1 inch in diameter and 1½ inches long. This tumor mass extended around the circumference of the pylorus. Serosa was normal. There was marked dilatation of the stomach. No evidence of other pathological process. The first portion of the duodenum was incised and opened and the pyloric canal was then found to be very narrow. It would just admit the tip of a hemostat. There was no evidence of other abnormality on the duodenal side. A diagnosis of hypertrophy of the pyloric muscle was made and the pyloric muscle was then resected and separated on the

posterior aspect, so that the mucosa was exposed but not incised. The serosa was sutured along the course of the incision.

Following operation, the patient had an elevated temperature for several days but this subsided and there was an uneventful recovery. The patient's general condition improved. Appetite became much better and there were daily evacuations of the bowel. Patient was discharged from the hospital on November 3, a month after admission.

Final Diagnosis. Hypertrophy of the pyloric muscle with stenosis.

November 20, 1930: Patient has shown gradual improvement. Appetite is very good. Patient feels better and is stronger but has not gained in weight. No vomiting.

Roentgen examination on November 20, 1930, about six weeks after operation, showed partial obstruction at the pylorus with widening of the pyloric sulcus and elongation of the pyloric canal. There was moderate atony of the stomach and marked hyperperistalsis in it. Stomach is much smaller than it was at previous examination but is still moderately enlarged. No six-hour gastric retention (Fig. 5).

September 19, 1931: At the present time, patient is in a good state of health. His appetite is fine; he has no stomach trouble; can eat anything; does not vomit and bowels are regular. He feels perfectly well and weighs 150 pounds, a gain of 60 pounds since time of operation about a year ago.

SUMMARY

It has been recognized since 1835 that hypertrophic pyloric stenosis occurs in the adult.

"Idiopathic pyloric stenosis" is suggested as the term which would best identify this condition.

The most characteristic roentgen findings are: Concentric and elongated pyloric canal, widening of the pyloric sulcus, and constant, unchanging appearance of the pylorus.

The diagnosis can be made by the correlation of the clinical manifestations and roentgen findings but not by the roentgen evidence alone.

Two cases of hypertrophic pyloric stenosis, proved by operation, are reported.

I wish to thank Dr. Frank J. Gallagher and Dr. G. Romano for the privilege of reporting these cases.

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DISCUSSION

Dr. V. A. Archer, University, Va. I have been interested in this subject for some time and there are several little points I would like to discuss.

First of all, in the body of the paper which Dr. McNamee did not read, he states that the condition is relatively rare. It is our belief in our clinic at the University of Virginia that this condition is not infrequent.

We have quite a number of operative cases now, perhaps nine or ten. I think that the reason it has previously been thought to be rare is that the full-blown cases, with marked tumor formation, such as the two that have been described, are relatively rare. However, there are all gradations of this condition from this marked tumefaction, such as was shown on the screen, down to the moderate or mild degree of obstruction. These mild cases will be considered by most observers to be simple pylorospasm. However, we have found in one case in our clinic that after the removal of a diseased gallbladder in the hope that this continued pylorospasm would clear up, it did not relax. Six months later a pyloroplasty was done, with symptomatic relief. Such occurrences have happened several times.

Now as to the etiology. It is our belief that a good many of these cases are perhaps congenital in origin. Many of these cases, if we go back in the history carefully, will give a history of being vomiting babies, more so than normal. However, a good many of them will show an association with gallbladder disease. We have been impressed with the fact that the moderate cases will show a coincidental gallbladder disease. However, the removal of the gallbladder will not cure this condition after it has developed, as has been proved several times, to our satisfaction at any rate.

We believe that long-continued pylorospasm will cause a hypertrophy of the musculature just as long-continued exercise of any other muscle in the body will cause hypertrophy.

An interesting follow-up on the first case that we reported some two years ago is as follows: This case was first seen in 1926, at which time I made an erroneous diagnosis of carcinoma. The patient was operated on, and a tumor was found, such as described. A pyloroplasty was done, a section taken out for quick section and was found to be benign hypertrophy. The patient went on, was perfectly well for about four years, then had some more gastric trouble, came back for gastrointestinal examination, and at that time we found a very large fungating carcinoma of the cardia and upper fundus. That upset me no little bit, naturally, because I thought perhaps we had been dealing with a localized linitis plastica of the pyloric region to start with, which later developed into a full-blown malignancy. However, we followed this case along, got in touch with his local doctor, and after a great deal of difficulty we drove fifty miles one night after twelve o'clock through the rain and fog and secured an autopsy. We took serial sections of the pylorus. We must have gone over 150 or 200 more sections, studying them very carefully, and not a sign of a malignant cell could be made out. On the other hand, the cardiac region showed extensive, cellular malignancy, and showed none the same characteristics. So that we do not feel that there was any connection between the two.

DR. B. R. KIRKLIN, Rochester, Minn. I have been very much interested in the group of cases which Dr. McNamee has discussed. We have observed at the Mayo Clinic a rather large number of these cases which have come to surgery with the finding of hypertrophy of the pyloric muscle. It is a well-known fact that prepyloric spasm is a fairly constant finding associated with ulcer on or near the lesser curvature above the angle of the stomach. I have sufficient respect for a prepyloric spasm to search again, if an ulcer has not been seen during the screen examination, to be sure that I have not overlooked a small ulcer responsible for the prepyloric spasm. It is also a well-known fact that small gastric ulcers heal and leave no gross scar. I would therefore like to speculate and suggest that possibly this hypertrophy of the pyloric muscle unassociated with other gastric lesions might be produced by long-continued spasm caused by a chronic gastric ulcer which has since healed. This condition is a source of possible error in the interpretation of the roentgenologic findings, in view of the fact that one is tempted to make a diagnosis of a prepyloric lesion. I think if one keeps in mind the fact that the filling defect is always more or less characteristically smooth, misinterpretation will be reduced to the minimum.

DR. MCNAMEE (closing). I brought up this subject because I think it is very difficult to make the diagnosis and because I wish to emphasize the importance of considering this condition in all cases of pyloric obstruction which are not obviously due to a large pathological process involving the pylorus. It has been suggested by one of the discussants that ulcer at the pylorus is the cause of this condition. A review of the surgical and pathological findings in the reported cases does not support this opinion. Hypertrophic pyloric stenosis is a definite and distinct pathological entity and occurs regardless of the presence of ulcer.

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CHONDRODYSTROPHIA FETALIS*

A ROENTGEN STUDY OF FOUR CASES; TWO IN FATHER AND DAUGHTER; EMPHASIZING THE EPIPHYSEAL CHANGES AND VARIANTS

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In 1920, a white male chondrodystrophic dwarf married a normal white female. They then went to their family physician to inquire if the husband's characteristics could be transmitted to their offspring, intending to have no children if transmissibility were possible. The physician assured them that any child born of their union would be normal.

"Heredity plays little part" (Osler,[11] 1909).
"The pituitary factor is important" (Osler,[12] 1920).
"The cause of the chondral anomalies is obscure" (Stevens,[16] 1923).

After the normal period of gestation there was born to this couple a female child. At two years of age the child seemed to the mother not to be growing. She had been bow-legged ever since she began to walk, in spite of daily libations of orange juice. When the child was four the parents realized that she had inherited her father's characteristics in toto.

The family physician's advice in the light of textbooks published even as recently as 1923 was correct; the hereditary factor had been overlooked. There arose, however, as early as 1912 in the minds of some investigators the suspicion that although this dystrophy might arise as a sport it was nevertheless a hereditary abnormality. Rischbieth and Barrington[13] wrote in that year, "It does not seem feasible to determine at the present day the proportion between hereditary and other causes." They suspected that it was hereditary for they recorded 80 pedigrees, 20 of which showed cases in two or more generations. The most noteworthy work in inheritance has been published by Bangson[1] who traced chondrodystrophia fetalis through five generations (Fig. 1), in two of which the parents were normal adults. We publish his chart because it proves adherence to the Mendelian law rather conclusively. Hunter[6] reported pedigrees extending through three generations of actors.

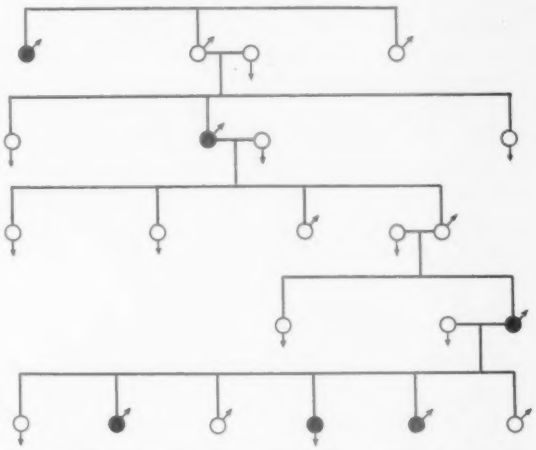


FIG. 1. Bangson's cases. Genealogy. Black dots are achondroplastics.

ETIOLOGY

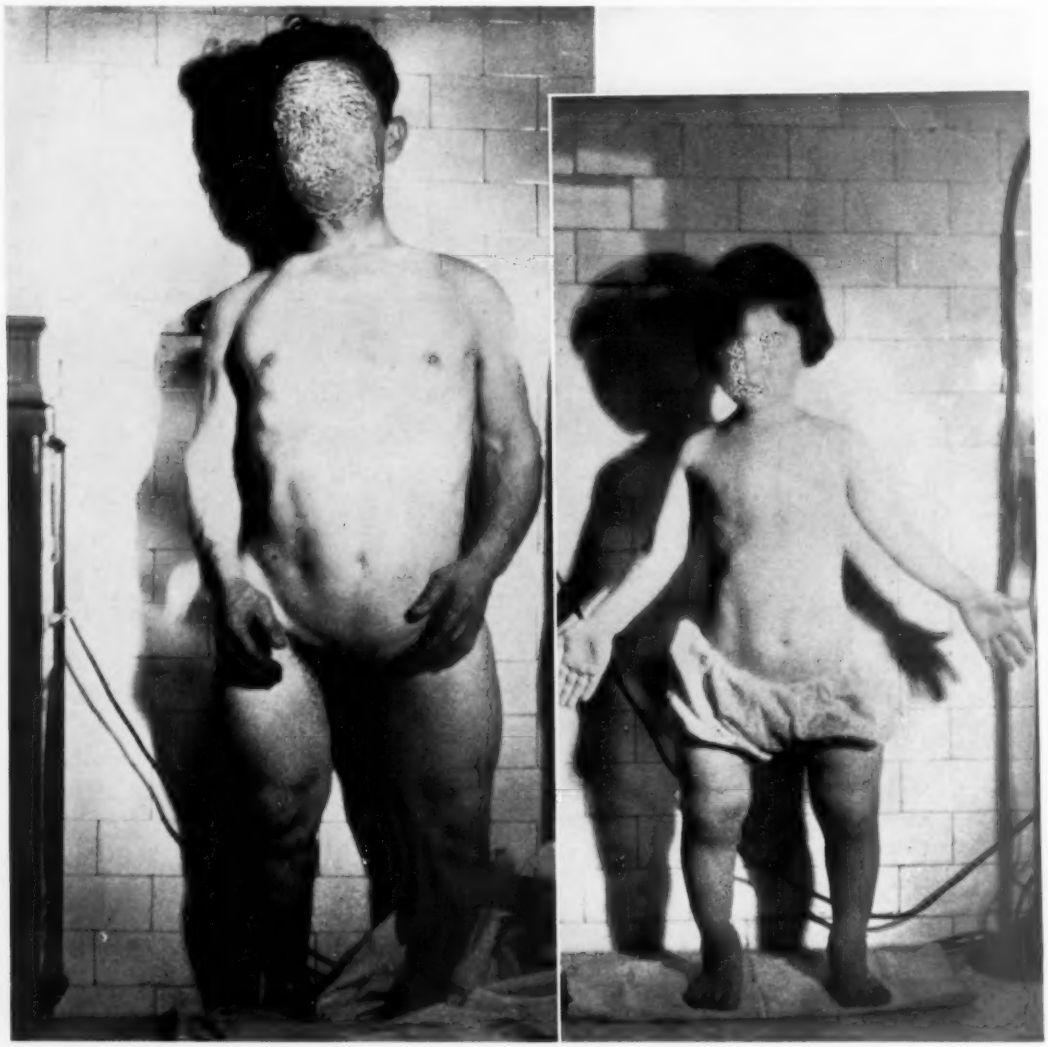
A retrospective glance at the various theories of causation shows two which hold the center of the stage—the theory of Jansen and the Dexter bull-dog calf phenomenon. Jansen's theory[7] is worthy of consideration for he recognized that the process began in utero. In brief, he believed that there was increased hydrostatic pressure and infolding of the amnion which produced the deformities incident to this chondral dystrophy. He postulated that the time of its occurrence was prior to the eighth week of gestation, after which time he held that cleidocranial dysostosis was produced by the same intrauterine factors.

This conception is both meritorious and convenient for it at once solves the problem of two transmissible chondral abnormalities.

* From the X-ray Departments of the Lancaster General Hospital and the State Hospital for Crippled Children, Elizabethtown.

The Dexter cow and bull-dog calf phenomenon was pointed out by Crew,[2] who suggested that these calves were true chondrodystrophics but as opposed to this there are febrile exacerbations during the period of gestation of the cows. In the human there are no reported febrile manifestations accompanying pregnancy. More important proof than this is that twins have been reported by Warner[18] in which only one twin was achondroplastic. It is difficult to conceive of an intrauterine infection which would be localized to one placenta and fetus. The Mendelian law holds, for homologous twins have been reported by Jones and Lovett.[8]

The theory of failure of some internal secretion has recently been reiterated by Mesz, Fliederbaum and Markuszewicz.[10] There is a very definite pathological basis for this conception. Normally the basilar process of the skull develops from three centers of ossification. Kaufmann[9] in his monograph notes the fact that only one center is present in these individuals and that produces a very short basilar process.



A B

FIG. 2, A and B. Cases I and II. Father and daughter.

This results anatomically in a steep clivus, a small pituitary fossa, a sunken bridge of the nose and a distortion of the three normal fossal steps. When one considers the growth disturbances which have already been localized to the pituitary body, viz., acromegaly and Frolich's syndrome, it is certainly not too far fetched to consider this as one of that group.

It is conceivable that the abnormal tribasilaris could prevent, hinder or impair the invagination of the primitive gut which traverses this region to form the anterior pituitary lobe. Practically all the cases reported show the changes in the tribasilaris and pituitary. Mesz, Fliederbaum and Markuszewicz contend that this is a syndrome of anterior pituitary lobe origin. Siegert[15] added a further disconcerting factor to the internal secretion theory by describing unilateral chondrodystrophic dwarfism.

CASE REPORTS AND ROENTGEN STUDIES

Case I. J.S., the father (Fig. 2A), aged thirty-eight. His standing height is 55 inches (137.5 cm.) He has been peculiarly free from disease and intercurrent infections from childhood. Possessed of great strength, he always participated in athletic games and was active in Boy Scout work. His mentality is good and intelligence above the average. He is self-supporting, being a talented watchmaker and jeweler.

The head is larger than normal, the facial features are large with an oval contour, the nasal bridge is not sunken. The torso is normal. The arms reach only to the level of the hip joints. The lower arm is short but the most conspicuous shortening is in the upper arm. The hands are large and do not show the main-en-trident changes. The genitalia are normal and the hairy distribution typical. The legs are very short, the femora and tibia sharing equally in the loss of length. The feet are very large.

Roentgen Findings. The skull shows a marked disproportion between the vault and the face, because the face is very long due to huge superior maxillary sinuses and a massive mandible which is not prognathous. The vault is thicker than normal. The pituitary fossa is low normal and massively formed (bony structure).

The ribs are not noteworthy. The clavicles reveal massive sternal ends, which taper sharply to the normal thickness. They present one curve, the inner half being straight and horizontal, the outer half is bent downward, drooping as though the arms were extremely heavy. The scapulae show an absence of the usual distinct angles and bony landmarks. The humerus is very short, measuring 9 in. (22.5 cm.), with a prominent deltoid eminence. The ulna is 8 in. long (20 cm.), the radius is $6\frac{7}{8}$ in. (17 cm.) in length and shows marked cortical thickening and bowing towards the dorsal surface. The bones of the hand and wrist are normal and the fingers vary normally in size. Arm length $21\frac{7}{8}$ in. (55 cm.).

The pelvis reveals a very narrow sacrum, with very inadequate alae. The pelvis is flat with the sacral prominence projecting far forward. The lower halves of the acetabula are absent and only about one-third of each femoral head articulates with them. The femora are 12 in. (30 cm.) long, but the neck is extremely short, making less than a right angle with the shaft—reversal of angle—coxa vara. The short femoral neck causes a very large greater trochanter to impinge on the ilium, where an anomalous fossa has been formed to accommodate it in abduction.

The tibia is 11 in. (27 cm.) in length, and shows a very slender lower third which broadens abruptly to form a large ankle joint. To match this the fibula forms a large external malleolus. There is genu varum. Other than its large size, the foot is negative.

Case II. E.S., the daughter, aged six, is 40 in. (100 cm.) in height. She passed an uneventful childhood but recently has developed a cardiac lesion apparently of rheumatic origin. Mental progress has been normal, she is intelligent, active and strong. She is innocent of her deformity.

The head is of normal size and the facial features small. The bridge of the nose is not sunken. The torso is normal. The arms reach almost to the mid-thigh, the upper arm is distinctly short, the lower arm and hand normal. The genitalia are normal.

The most striking shortening is in the lower extremities. If a card is held over the lower half of the photograph (Fig. 2B) the child might pass as normal, but on removing the card the striking foreshortening of the lower limbs is evident. There is genu varum.

FIG. 3. Case II. Right forearm, carpus and metacarpus. Note crenation of temporary zone of calcification and increased width of cartilaginous plate.

Roentgen Findings. The facial bones are small; the vault relatively large. The basilar process is short; pituitary fossa low normal, the clivus steep; the middle fossal step almost lost. The fontanelles are closed; the deciduous teeth are erupting normally. The ribs are negative, and the clavicles are like the father's, as are also the scapulae. The humeri are very short, $6\frac{1}{2}$ in. (16 cm.) with an irregular curvature of the shaft, the lower end is gnarled. The deltoid eminence is located in the center of the shaft. The ulna, $5\frac{3}{8}$ in. (13.5 cm.) long, is fairly straight, but the olecranon is clubbed, with flaring of the lower metaphysis. The radius is $4\frac{5}{8}$ in. (9 cm.) long with lateral bowing and a very thick cortex. The interosseous space is well preserved. The hands do not show the main-en-trident deformity and the epiphyses are not strikingly characteristic of the disease. The arm length is $16\frac{1}{8}$ in. (40 cm.). Vertebrae are negative. The child's pelvis is a replica of the father's.

The femora are $8\frac{1}{2}$ in. (21.0 cm.) long with abrupt enlargement of the lower metaphysis and knee joint. The tibiae and fibulae are short, $6\frac{7}{8}$ in. (16.3 cm.), with striking epiphyses, discussed elsewhere. The foot is negative.

A study of these 2 patients and the literature convinced us that chondrodystrophia fetalis varies considerably in its manifestations, which variation could be grouped into (*a*) variations in the groups of epiphyses involved and (*b*) the degree of their involvement. As an example, the main-en-trident hand is considered in every textbook and many articles as a typical manifestation of the dystrophy. Frangenheim[4] in his work on achondroplasia in 1913 be-

FIG. 4. Case II. Right knee. Note fraying of the temporary zone of calcification, width of cartilaginous plate, response to Wolff's law on the shaft of the femur. Also relative and absolute increase in size of knee joint (patient aged six).

lieved that a roentgenogram of one hand was sufficient to make a diagnosis. The hands of neither patient here reported show the main-en-trident feature. Obviously we are dealing with clinical entity with variants.

Wheeldon[19] reported a new sign of achondroplasia, i.e., wedged-shaped vertebrae, in 1920. Curiously enough Fussell et al.[5] in 1909 published the photograph of an achondroplastic dwarf with marked kyphosis. In our study Cases I and II showed no vertebral involvement.

In addition to this our patients had genu varum and from numerous sources and illustrations (Fussell et al., Jones and Lovett, Lewin), this seemed to be characteristic of the dystrophy. To our surprise, Delafield and Prudden[3] published a photograph of an achondroplastic child with genu valgum. Further confusion was lent to the picture by Ruggles[14] who published an article entitled "Dwarfism due to disordered epiphyseal development," in January, 1931. Comparing his illustration (Fig. 7), a lateral spine, with that of Wheeldon also reproduced by Jones and Lovett, we find them almost identical. Further his patients, Earl B. (Fig. 1), Francis B. (Fig. 2), and Morton W. (Fig. 5), show genu valgum as does Delafield and Prudden's patient.

At this point in our study, we had the good fortune to examine our third and fourth patients whose findings we wish to compare and contrast with the previous cases herein reported.

Case III. N.P., male, aged four (Fig. 6), was of Italian parentage. The paternal and maternal grandparents were normal, as were also all the aunts and uncles. He was one of six children, the others being normal. At three months of age the parents noted a "lump in the back and bowing of the sternum." At two years of age he was studied at the Episcopal Hospital, Philadelphia. Other than the prescription of braces nothing was done. He was admitted to the Elizabethtown State Hospital for Crippled Children on June 20, 1930.

A few points from the physical examination by Dr. Francis Chambers on admission are interesting when compared with Ruggles' cases: "The neck is short. There is angulation (90°) between the manubrium and the gladiolus, and the upper segment of the sternum almost comes in contact with the chin. Knees are in genu valgum. The lower costal cartilages are in con-

Fig. 5. Case III. Right forearm. Note obliquity of lower metaphyses, radius and ulna. Characteristic changes in bones of the hand, especially cancellous structure.

FIG. 6. Case III. Note genu valgum.

tact with the iliac crests. Feet pronated flat." It is of great interest to note that extension on a Bradford frame produced slowing and irregularity of the heart (tension on the vagi?).

Roentgen Findings. Skull—not examined. The ribs are very broad with a suggestion of involvement at the vertebral ends (Fig. 7). The anterior ends flare very definitely. The radius is very much increased in diameter, with a cupped lower epiphysis. The ulna shows the same changes; both epiphyseal lines are oblique, angling to meet each other at the radio-ulnar articulation (Fig. 5).

All of the long short bones of the hand are involved with a definite tendency to the main-en-trident feature of the metacarpals; the fingers, however, are of normally differing lengths. All dorsal and lumbar vertebrae are seriously involved with wedging in the dorsolumbar region, and kyphosis (Fig. 8). The sacrum is involved similarly. The acetabula are very imperfect. The femoral head and trochanters are present (Ruggles' cases had no epiphyses), and the femoral neck is long and in coxa valga. The typical epiphyseal disturbances are evident but not marked. The lower ends of the femora show no sudden expansion and the femora are straight. The knee joint is almost normal (see Ruggles' cases)—genu valgum.

CASE IV. L.F., male, aged eight and a half. No history of similar dwarfism in parents or grandparents. The child was a breech presentation, otherwise normal, but during the early months of infancy the head increased rapidly in size. He began walking at thirteen months, at which time shortness of extremities was noted. Attacks of weakness were frequent. The head continued to increase is size until three years ago.

FIG. 7. Case III. Anteroposterior view of spine, upper half of the pelvis and lower vertebral portions of the ribs. Note broadening of ribs, trabeculation through cancellous bone.

The child was 38½ in. (96 cm.) tall with a cranial circumference of 24¾ in. (62 cm.). Saddle-shaped nose and prognathous jaw. There was marked lumbar lordosis. The extremities are well covered by solid muscles and fat (Fig. 9).

Roentgenograms of the skull (Fig. 10) show marked enlargement of the cranium, especially in the frontal region, with great thinning of the skull. The tribasilaris is large, pituitary normal, the three fossal steps well preserved. The bridge of the nose is retracted. The ribs have a tendency to flattening and broadening. The vertebrae are normal except the first and second lumbar which show typical changes observed in Case III. The humeri are extremely short, 4⅝ in. (11.3 cm.), with a large deltoid eminence above the center. The radius and ulna are short and massive. The metacarpals are about equal in length, although the fingers vary. The pelvis is very flat due to the protrusion of the sacral prominence. The femora are large in diameter, 7⅜ in. (18.4 cm.) long and with slight coxa valga. The knee joints are massive, as are the tibiae and fibulae. The tibia is 5⅞ in. (14.6 cm.) long.

HISTOPATHOLOGY

In this presentation of 4 cases it is evident that they fall into two contrasting groups, neither group fulfilling all of the criteria originally given for the diagnosis of this dystrophy. These conflicting findings can be summarized as Mesz et al. suggest:

Essential Differential Characteristics

Group 1 Cases I and II	Group 2 Case III
1. Genu varum	1. Genu valgum
2. Heavy musculature	2. Weak musculature
3. Normal growth of hair	3. Sparse hair growth
4. Central character of shortening of the extremities.	4. Peripheral type of shortening of the extremities.

Case IV belongs to Group 1 but without the bow legs.

Kaufmann after studying 13 cases published his monograph, "Untersuchungen über die sogennante foetale Rachitis" in which he postulated three types of this dystrophy: (*a*) hypoplastic, (*b*) hyperplastic, (*c*) malacic. These he postulated on the histological picture.

Fig. 8. Case III. Lateral view of spine. Note wedge-shaped vertebrae, curious beak on inferior anterior portion of vertebral bodies, kyphosis dorsolumbar junction; also feathering of articular processes and vertebral spines.

I quote from Reimann's translation of Kaufmann's Surgical Pathology: "In the hypoplastic type the proliferating cartilage is unable to produce sufficient longitudinal rows." "In the hyperplastic or rarest

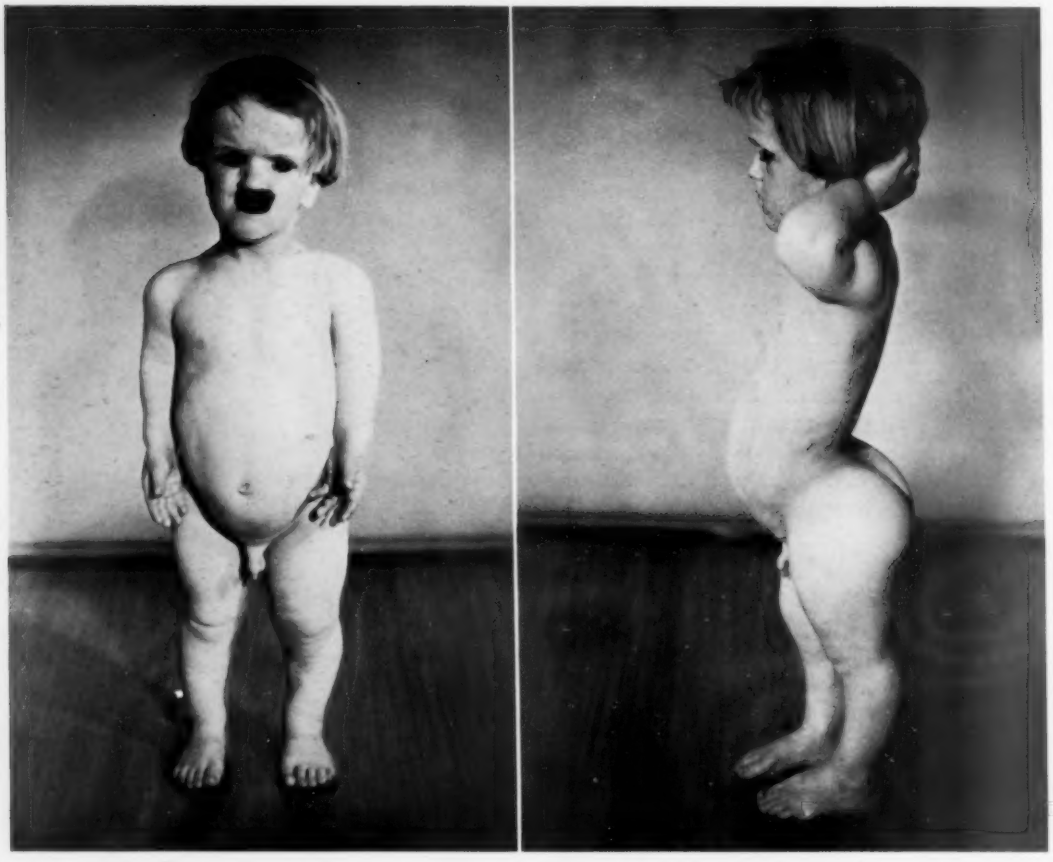


Fig. 9. Case iv. Note absence of genu varum or valgum, marked lumbar lordosis, large head, depressed nasal bridge, increased musculature, normal genitalia.

Fig 10. Case iv. Roentgenogram of skull. Note marked increase in size, oxycephalus. Anterior fontanelle far posterior to normal position. Also note retraction below the glabella.

type the cartilage is of normal hardness but grows undisciplined so that thick broad fungus shaped epiphyses are formed on short diaphyses. Siegert says A and B may be combined." "In the malacic the proliferating cartilage is softened.

Subsequently clinicians tried to fit a histological picture to the physical entities and failed. More recently the roentgenologists have studied this disease and they too should have tried to fit the histological picture to the roentgenographic picture. Obviously this is difficult, so that Tchougounoff and Sourkoff[17] from the clinical aspect have developed a classification differentiating peripheral and central types and adding a mixed type. This is difficult to correlate with the roentgenographic and histological picture. We must come back to the original contention of

Kaufmann and think of the dystrophy as consisting of three elements, all of which are perhaps present to a greater or lesser degree in each person. As occurs so frequently in medicine, rigid rules or diagnostic standards are difficult to describe. There must be some variation depending on the particular histological picture present.

DISCUSSION

In considering chondrodystrophia fetalis from the roentgenographic standpoint, we

Fig. 11. Case IV. Forearm, carpus and metacarpus. Note broadening of metaphyses lower end radius and ulna, narrow cartilaginous plate comparative slight crenation, few typical changes in carpus and metacarpus. Also extreme shortness of radius and ulna, their straightness and comparative increase in size.

Fig. 12. Case IV. Knee and lower leg. Note straight long bones of enormous diameter (patient aged nine). Also note irregularity of the femoral center of ossification, regularity of the zone of temporary calcification with line-like width of cartilaginous plate.

should therefore attempt to interpret our findings in light of histology, and so record them. The hypoplastic type is the most common. In our Cases I and II we have the hypoplastic type of achondroplasia, with occasional areas of hyperplasia. The proximal portions of the extremities are very short, and they are markedly bowed (Fig. 2). This bowing we believe is an evidence of the hypoplasia. Bone originates from two sources: it is first laid down in the lengthening of the extremity by endochondral ossification, and then the cortex is added to by periosteal new bone formation. It seems that the original laying down of the bone in these hypoplastic cases is so inadequate or so low in tensile strength that bowing occurs. The periosteal bone formation which is normal attempts to correct this by laying down bone on the concave side of the bowed long bone (Wolff's law). Note the lower epiphysis of the femur (Fig. 4) to see the exact phenomena illustrated. The cancellous bone is produced by endochondral processes—in these hypoplastic cases few well-defined trabeculae are seen in the mid-region of the shaft—at the metaphysis the trabeculae are very fine, thread-like, more numerous than usual and form a delicate lacework.

FIG. 13. Case IV. Lateral roentgenogram of spine. Note wedging of the twelfth dorsal and the first lumbar vertebrae. Those above and below not involved.

The greater number of the epiphyses in Case II show increased transverse linear markings in the zone of temporary calcification which is abnormally broad and not well defined on the diaphyseal side. The zone runs transversely, i.e., normally, to the axis of the shaft. The cartilaginous plate is broad due to increased osteoid tissue (Figs. 3 and 4).

Attention is called to the difference between the epiphyses at the knee (Fig. 4) and the lower radial epiphyses (Fig. 3).

The lower radial epiphysis in Case II shows marked crenation of a sharply defined and densely calcified zone of temporary calcification. Is this due to function—i.e., prehension in the wrist and weight-bearing in the knee? We believe this is a difference in character of involvement in the same individual.

In Case III we note a different type of this disease. The involvement of the long bones of the extremities is not spectacular. However, the vertebral involvement and the changes in the carpus are extensive. The phalangeal changes are not so marked as in many previously reported cases of achondroplasia. Because of the mild degree of the involvement of the proximal extremities the shortening is not marked. The bones are well constituted. On the other hand, the vertebrae are involved in a malacia. They present an anterior beak along the inferior border, the zones of temporary calcification are densely calcified but straight spicules of bone project in unusual locations into the osteoid tissue of the cartilaginous plate. The articular and spinous processes are represented by a group of densely calcified trabeculae, distinct as a steel etching but very irregularly formed. The intervertebral discs are wider than normal. This wedging of the vertebrae produces kyphosis.

Contrast the three wrists (Figs. 3, 5 and 11), and note the obliquity of Case III, the failure of crenation and the presence

of cupping, where the osteoid tissue of the cartilaginous plate has been infiltrated by irregular columns of cells attempting to grow downward. The cortex of the radius is densely calcified and thickened. The trabeculae of the cancellous bone are atypical in their arrangement, and are larger but fewer in number than normal. The process in the metacarpus and the phalanges is the same as that seen in the vertebrae.

Case IV belongs to the hyperplastic type—these bones are twice the diameter of those in normal children of this age. This is especially seen in the tibia (Fig. 12). They are straight, indicating strength at all ages. The child is neither bow-legged nor knock-kneed. In the hyperplastic type the process of endochondral ossification produces an extremely hard, sclerotic type of bone upon which foundation periosteal bone formation may proceed. The trabeculae are thin, numerous and poorly delineated.

The epiphyses show as a striking feature, a very narrow cartilage plate, which is so inadequate that permanent union seems imminent (Fig. 11). Contrast the knees of Case II (Fig. 4), with Case IV (Fig. 12). The striking changes in the zone of temporary calcification are absent in Case IV except at the lower ulnar epiphysis which shows the dense calcification, fungation and crenation. These 3 cases in which the epiphyses can be examined present three contrasting types, each distinct from the other but still adequately described by the term chondrodystrophia fetalis,[1] Case II, the hypoplastic type predominating; Case III, the malacic type predominating; Case IV, the hyperplastic type predominating.

CONCLUSIONS

1. Four cases of chondrodystrophia fetalis are studied from the roentgen standpoint, in an attempt to correlate the clinical with the histological picture as described by Kaufmann.

2. Roentgenograms of the epiphyses in the young afford the best method of study.

3. We believe that the three Kaufmann types may be present in the same patient, one process predominating, this accounting for the many variable findings in our reported cases and others discussed herein.

4. We believe that in the same individual the several groups of bones may vary in the severity of their involvement, e.g., the wrist more than the knee, the roentgenogram revealing the results of a differing histological picture.

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Vol. XXIX, No. 1

CLINICAL ILLUSTRATIONS OF DEEP ROENTGEN-RAY AND RADIUM BURNS

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INTRODUCTION

IN AN article dealing with deep burns caused by roentgen rays and radium recently published in this Journal,[1] I considered in a general way the dangers of roentgen rays and radium and the treatment of burns caused by these agents. It seems advisable to supplement this article with another showing typical cases of these burns and giving a more detailed account of the problems presented and the methods of treatment used in disposing of the changed tissues.

I should like to make it plain that this paper is not written to belittle in any way the extraordinary therapeutic value of both roentgen rays and radium, but it is intended simply as a warning of the disasters which may be caused by these agents. It seems to me that if these dangers are brought graphically to the attention of those using roentgen rays and radium, much more care may be exercised and in consequence fewer burns may occur.

For purposes of convenience, the cases will be assembled into three groups as follows:

1. Burns of the head and neck.
2. Burns of the trunk.
3. Burns of the extremities.

The cases illustrated have come under my care from various sections of the country and most of the patients have been treated by different operators, some in private offices and others in hospital clinics. These cases have been selected from a large gallery of radiation burns either for the purpose of demonstrating the varied type of lesion, or to emphasize some method of treatment.

It was impossible in the majority of instances to get more than a very sketchy outline of the methods of exposure; in fact, when multiple treatments were used, often even the number of treatments could not be definitely stated. As I have said elsewhere, the majority of these burns have followed the therapeutic use of roentgen rays and radium in dermatologic and other clinical conditions and this can be verified in following the story of the cases presented.

In order that it may be more convenient for those who do not have the article previously referred to at hand, I will recapitulate the clinical and microscopic characteristics of roentgen-ray burns. Radium burns show practically the same picture so that one description will answer for both.

CLINICAL CHARACTERISTICS

The depth of the burn may vary in different portions of the affected area. The clinical appearance is somewhat as follows: The burned area is often tightly adherent to the underlying tissue and may be somewhat depressed. There are usually patches of keratosis and one or more chronic ulcers which may be superficial, or may involve the full thickness of the skin and also a considerable depth of the underlying soft parts. Some of these ulcers heal very slowly and break down again and repeat this process, while others never heal without operative intervention. The nonulcerated and healed portions are hairless and atrophied; sometimes wrinkled and sometimes smooth; usually dry and shiny and may or may not have blotchy brownish pigmentation. In the majority of instances, there are characteristic telangiectases which may be discrete or may occur in patches.

The edges of the ulcers are thickened and hard, grayish-red and frequently everted

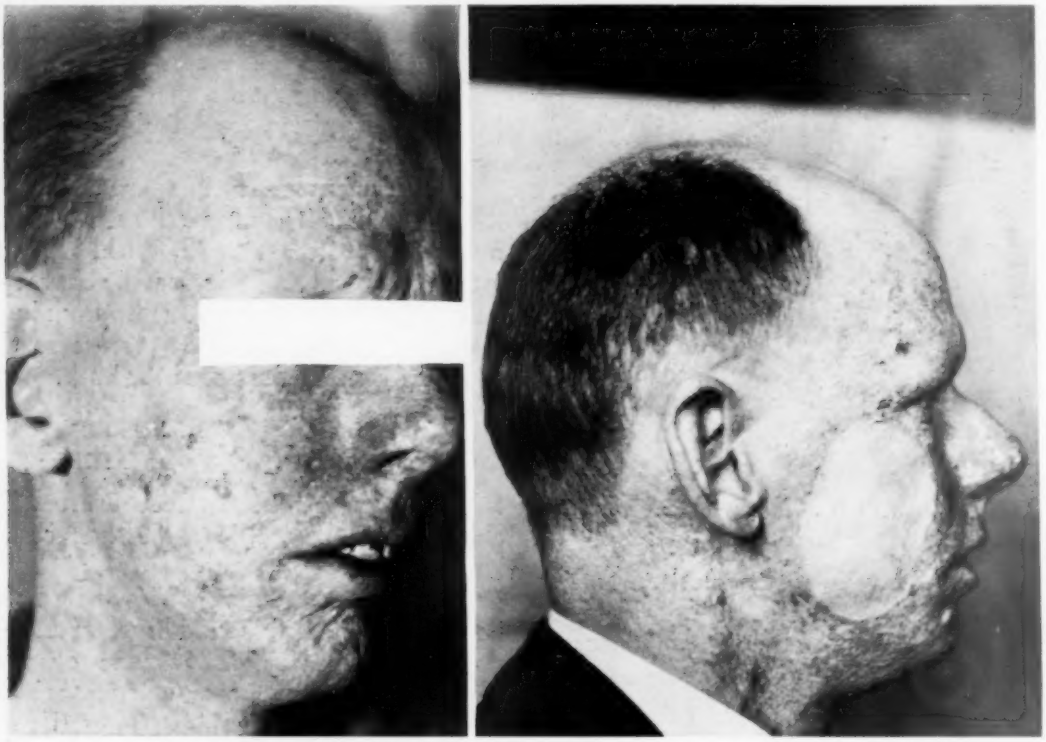
[1] Deep roentgen-ray burns. Am. J. Roentgenol. & Rad. Therapy, December, 1931, *26*, 890–893.

and often give the impression of malignancy. The floor of the ulcer is covered with a mass of tightly adherent, yellowish-white necrotic tissue.

The outline of the involved area both laterally and vertically is without definite limitation, and it is impossible to tell the depth of the destructive process until exploration is done. The changed tissues are very hard; the subcutaneous fat may be completely destroyed; the muscle may be infiltrated, or entirely replaced by scar tissue; there may even be marked necrosis of the underlying bone. Extreme sensitiveness is characteristic of the deep burns regardless of their size. The burning, boring pain in the ulcerated area is intense and may be due to irritation of the nerve endings caused by infection; to changes in the nerves themselves caused directly by the rays, or by the progressive obliteration of the blood vessels, or to pressure on the nerves by scar. Any one or all of these conditions may exist.

MICROSCOPIC CHARACTERISTICS

There is keratosis at the edge of the ulcer with atypical down growth of epithelium, with or without pearly body formation; a very superficial zone of cellular granulation tissue; unusual scar tissue formation which, as a rule, extends to and involves the muscles; thickening of the blood vessel walls with endothelial obliteration. The hair follicles, the sweat and sebaceous glands are destroyed.



A B

FIG. 1. CASE 1.

RADIATION BURNS OF THE FACE AND NECK

Fig. 1. Illustrating skin changes caused by multiple treatments with roentgen rays for eczema and later by radium treatments for keratotic areas which had developed.

CASE 1. The patient is thirty-three years old and had been treated a number of times with

roentgen rays for eczema, beginning thirteen years before and marked skin changes resulted. Subsequently radium was used a number of times to treat these changes.

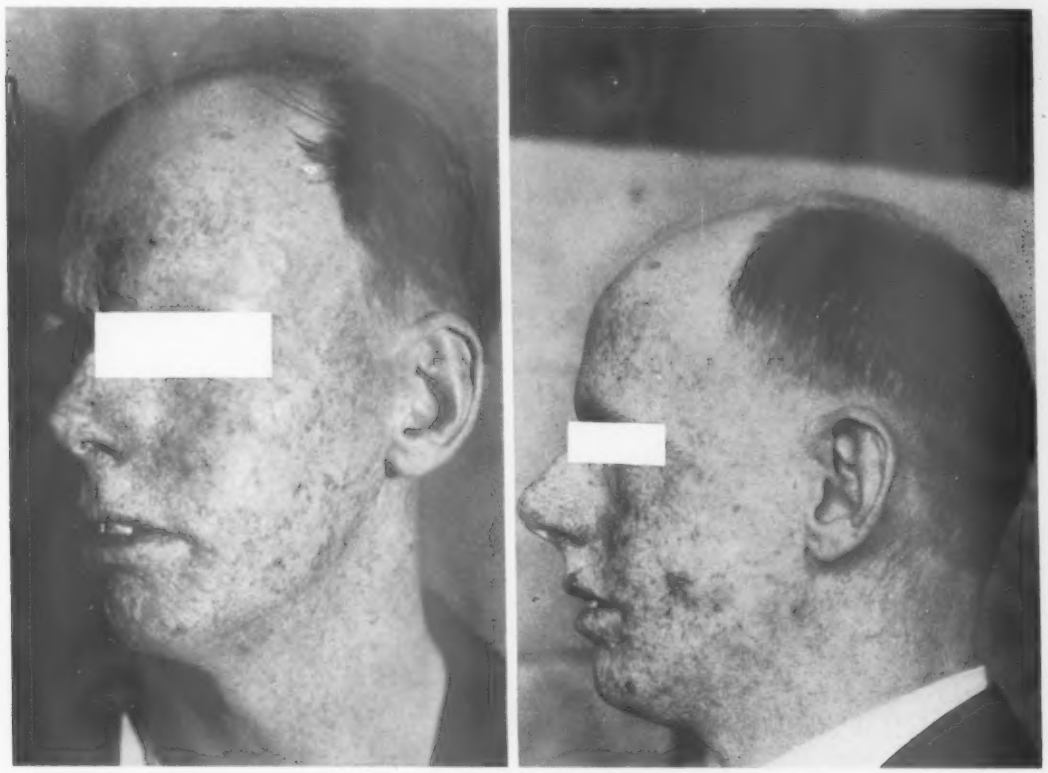
A. Note the dry, atrophied, scarred and blotchy appearance of the face and forehead and the numerous keratotic patches scattered over the entire area. There are also telangiectatic patches. The skin is very easily irritated. The hair follicles of the eyebrows and beard have been destroyed and those of the lashes are much affected. There are no palpable glands in the neck. There is some ulceration and quite marked keratosis of the skin of the right cheek and this at the time is the most disturbing area. This tissue was excised with a wide margin and the defect immediately grafted with a thick Ollier-Thiersch graft.

B. Result of grafting after fourteen months. The graft is smooth and soft and except for its pale color is quite satisfactory.

Fig. 2. Case 1. Illustrating the degeneration which can take place in a comparatively short time in skin changed by roentgen rays and radium.

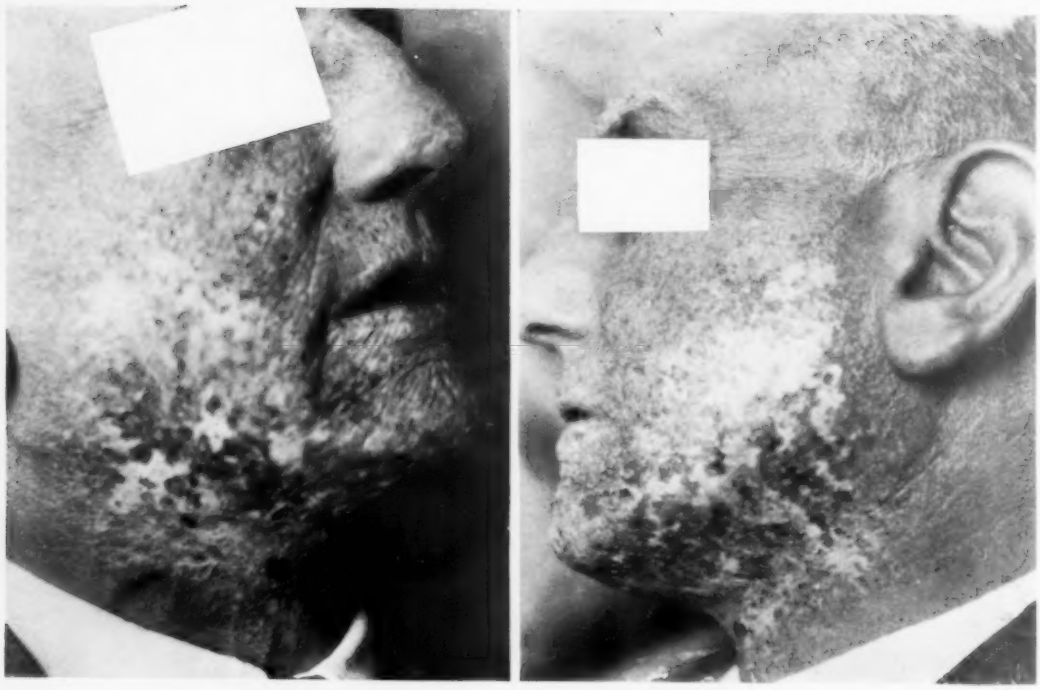
A. The left side of the face of the patient shown in Figure 1. Note the typical changes caused by radiation treatment as previously described.

B. Taken fourteen months later. Note the increase in the number and size of the areas of keratosis. There was also a large patch on the left side of the upper lip and the left cheek and on the right side of the chin. During the interval of fourteen months, all of these areas had been given radium treatments, elsewhere, when they began to increase in size. No improvement followed but further extension of the lesions resulted. The treatment in this case was excision with closure on the upper lip, excision with immediate grafting (Ollier-Thiersch) of the area on the right side of the chin and on the left cheek. The cautery knife was used for the excisions. In a case of this kind radium and roentgen treatment of keratotic areas seems to aggravate the condition rather than to help it



A B

Fig. 2. Case 1.



A B

C D

Fig. 3. Case II

and should not be attempted. Microscopic examination of tissue removed from the left cheek showed neurosarcoma.

Fig. 3. Illustrating roentgen-ray burns of the face and neck with delayed appearance.

Case II. The patient is sixty years old. Fifteen years ago, he had three roentgen treatments a week for five months for some infection in his beard. The burn which followed did not manifest itself for at least a year after treatments were discontinued. The patient was later treated with ultraviolet rays for a while and thought improvement followed but since then the condition has been aggravated.

A–B. Note the typical roentgen changes of the burned skin; atrophy, dryness, telangiectasis, loss of hair, keratosis and areas of ulceration which heal and break down. At this time ulceration is principally on the neck and left cheek. The patient is unable to raise his chin more than is illustrated. There is much discomfort and great pain.

C–D. Showing the result of treatment following two admissions. The ulcerated and keratotic patches were excised and the areas were covered with Ollier-Thiersch grafts. Note the grafts on both cheeks, the neck and right ala. The patient has lost the sensation of tightness and pain, has much more freedom of motion and at present, after several years, is in excellent condition. All the areas excised showed at some portion of the specimen "precancerous" lesions.

Fig. 4. Illustrating the use of a tubed flap in repairing a cheek defect due to a radium burn.

Case III. The patient, a woman aged thirty-two, had an angioma of the cheek which was operated on elsewhere without success. Subsequently several radium treatments were given and a radium burn followed. Quite severe involvement of the maxillary bones on the right side followed and much scar had formed. The buccal sulcus on the right side above and below was obliterated and the patient could not open her mouth.

A. Note the atrophy of the tissues and the perforation through the cheek. The skin presented typical radium changes. Note the tubed flap with its "frying pan" shaped lower portion which was to be used in lining the cheek.

B. The buccal sulcus above and below was cleared. The flap was inserted through an incision along the margin of the lower jaw, with its skin side toward the mouth, and was sutured into position, thus giving an outside lining to the sulcus above and below. There was difficulty in checking the hemorrhage as angiomatous tissue remained in spite of the radium and very abundant scar tissue. Note the tubed pedicle carrying the blood supply from the neck to the lining of the cheek.

C. The pedicle of the flap was later opened up and used to reconstruct the outer portion of the cheek after further excision of tissue changed by radium.

D. The mouth could be opened fairly well following the reconstruction of the cheek.

Fig. 5. Illustrating the removal of a roentgen-ray burn by gradual partial excision and the use of a fat and fascia graft to compensate for the atrophy of the cheek and lower jaw.

Case IV. Female, aged twenty-two. Gives a history of having had an infection on the right cheek when she was about ten years old. The infected area was lanced and following that she had roentgen treatments, twice a week for six months and once a week for the next six months.

A. Shows an area of changed tissues on the right cheek. There is atrophy of the cheek and flattening of the lower jaw on the right side, giving a marked asymmetrical appearance. In the changed areas the cheek varies in thickness, the pigmented telangiectatic area around the white portion of the scar being considerably thinner than the white portion. There is some keratosis but no ulceration.

B. Result of the second step in gradual partial excision. Note that the changed tissues have been practically removed without puckering the angle of the mouth.

C. Shows the atrophy of the face and consequent asymmetry on the right side due to the roentgen-ray changes.

D. Result of turning in adjacent fatty tissue and of implanting a fat and fascia graft to fill out the defect.

Fig. 6. Cases illustrating the destructive effect of radium on an area previously treated by roentgen rays.

A. Case V. Male, aged fifty-nine. There was originally a very small scaly growth on the ala

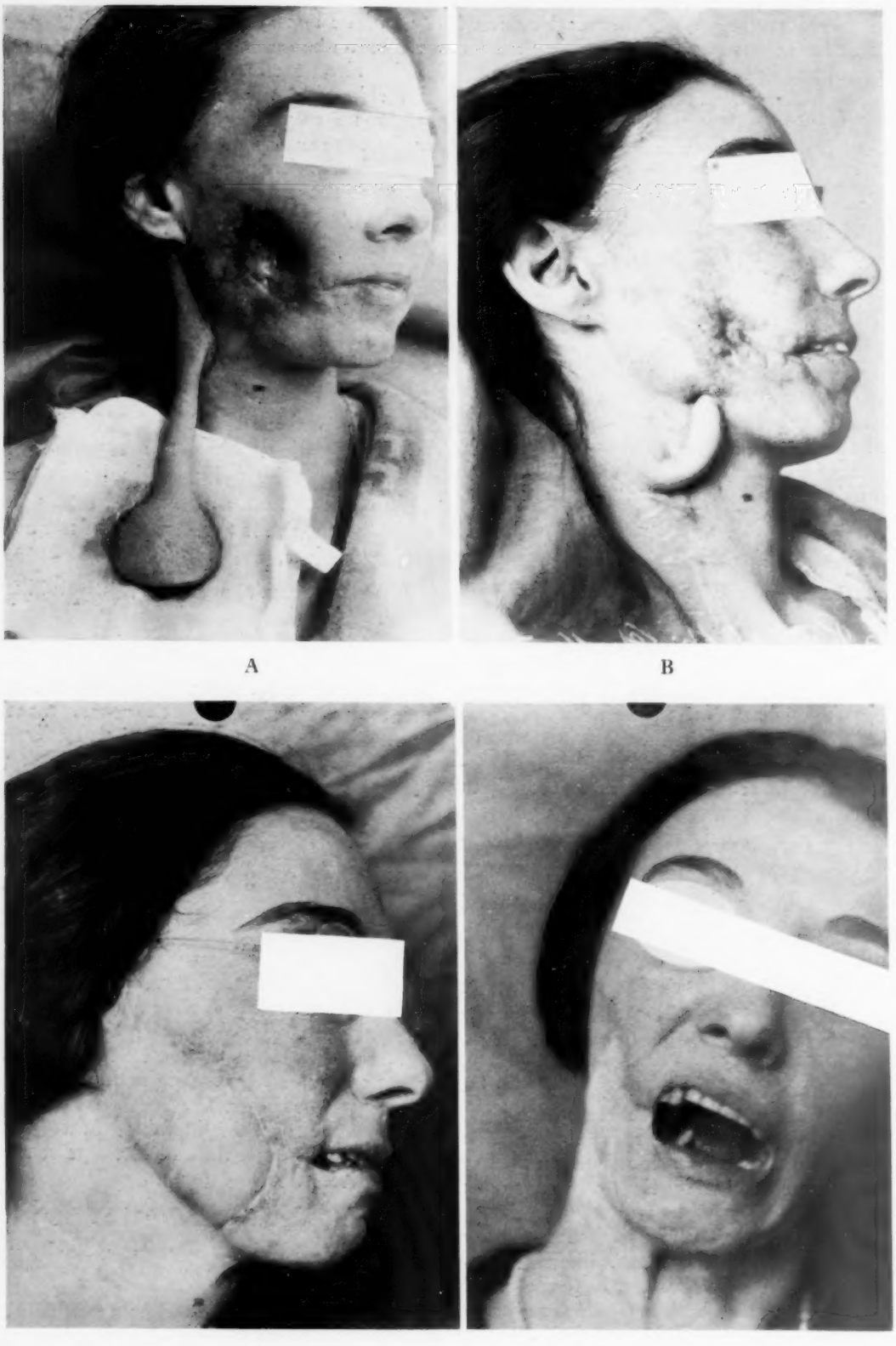


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Fig. 4. Case III.

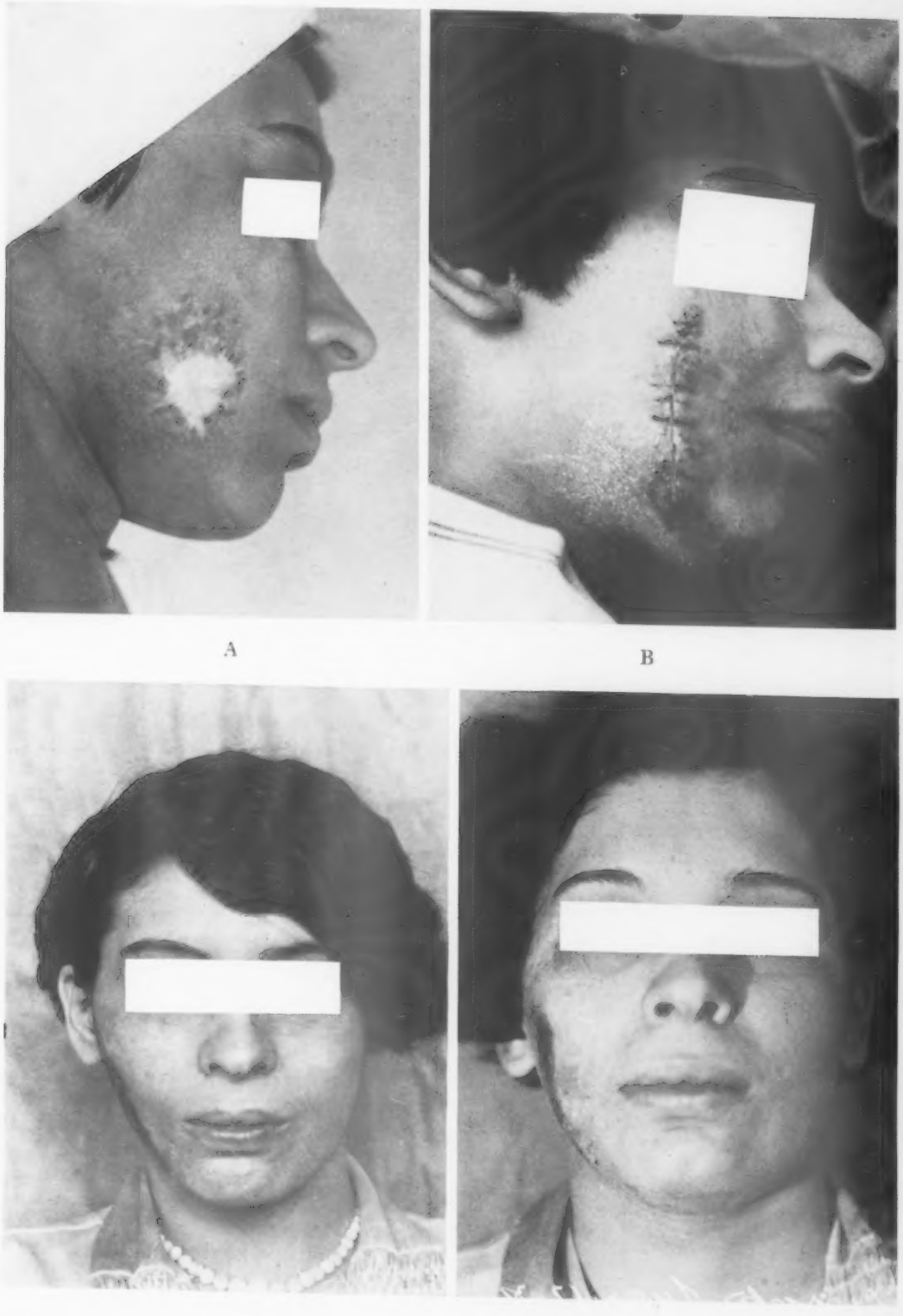

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Fig. 5. Case iv.

close to the nasolabial fold. The treatment used was roentgen rays several times, then several radium treatments which were followed by a radium burn and much destruction of tissue. Note the destruction of the left ala and adjacent soft parts of cheek and upper lip. There has also been bone destruction beneath this area. The roots of teeth which have been devitalized by the rays are visible. Subsequently the remaining portion of the upper lip on the left side was excised and the teeth and necrotic bone removed. Then an extensive reconstruction was carried out to repair lip and cheek.

A B

FIG. 6. CASES V and VI.

FIG. 7. CASE VII.

B. CASE VI. Male, aged fifty-three. There was a small growth on the nose about the size of an ordinary pinhead. This was treated several times with roentgen rays with some reaction, but no burn. Then it was treated with radium eight or ten times, and was burned by one of these treatments. Two subsequent radium treatments were given. The growth, whatever it was, was destroyed, but in the process a radium burn was received and this burn was deep enough to destroy not only the growth itself, but the adjacent soft parts and the bone and mucous membrane of the nose beneath. The opening into the nose can be seen. There

are also radium changes in the skin of the cheeks and nose and forehead. The repair of this nasal defect required the transfer of a lined pedunculated flap from the forehead and a very satisfactory result was finally obtained.

Fig. 7. Illustrating the destructive action of radium in the treatment of exophthalmic goiter.

Case vii. The patient, a young woman, had quite marked exophthalmic goiter with the usual symptoms and was given several treatments with radium over the thyroid region. The goiter symptoms were much improved, but in the process there was destruction of the overlying soft parts and of a portion of the thyroid and cricoid cartilages and the anterior three-fourths of the trachea just below. Note the tracheal opening and the destruction above it. Also the typical radium changes in the surrounding skin. Considerable improvement was made by reconstruction of the anterior wall of the trachea with costal cartilage and skin flaps.

Fig. 8. Illustrating the method of gradual partial excision in the removal of a roentgen-ray burn of the neck and face.

Case viii. The patient had a number of treatments, twelve years ago, with roentgen rays for superfluous hair, and was burned. The neck is stiff and cannot be turned without difficulty. There is pain and tightness. The area heals and breaks down constantly. It occupies the lower portion of both cheeks and the neck down to the clavicles.

A. The burned area is thick, dry, mottled, rough in some areas and smooth in others. There was marked telangiectasis. There are several areas of ulceration. On account of the position, extent and condition of the adjacent skin, gradual partial excision was determined on as the method of choice.

A B

Fig. 8. Case viii.

B. The first step in gradual partial excision. The wound from which a strip 10 cm. long and 4 cm. wide at its center had been excised included some of the most badly involved areas. This process of excision was continued at different times over different portions of the burned area until nearly all of the most severely changed tissue had been removed. There is no ulceration, pain has disappeared, the neck can be turned normally and the patient's general condition and mental attitude are tremendously improved. That portion of the tissue which still remains is very slightly involved and

after several years shows no sign of keratosis and ulceration.

Fig. 9. Illustrating the use of a single pedicled flap for the relief of a roentgen-ray burn of the neck following treatment for tuberculous glands of the neck.

Case ix. The patient, a young woman, about thirty years old, had multiple treatments with roentgen rays fifteen years before admission. A burn followed these treatments which did not heal for nine months. Since that time the burned area has broken down and healed, over and over again.

A. At present a large depressed area presenting typical radiation changes can be seen, and in the lower central portion are two ulcerated areas. There is pain, limitation of motion and constant discomfort. The dark mark across the neck is the outline of the upper edge of the single pedicled flap from the neck and back with its pedicle in front which was raised and shifted upward to fill the defect left by the excision of the burned area. The removal of the burned tissue was difficult on account of the depth of the involvement. The mastoid portion of the sternocleidomastoid muscle was entirely fibrosed.

B. Result after one year. Note the condition of the flap consisting of normal skin and subcutaneous fat which was shifted into the defect made by the removal of the changed tissue. The area from which the flap was raised was grafted with Ollier-Thiersch grafts and can be seen. The neck can be moved normally. There is no further discomfort and there has been no further trouble during the twelve years since operation.

A B

Fig. 9. Case ix.

Fig. 10. Illustrating the use of a double pedicled flap in the cure of a deep roentgen-ray burn of the neck involving the larynx and neck muscles.

Case x. The patient is fifty-two years old. Seven or eight years ago the thyroid was treated with roentgen rays, the theory being that this procedure would cure psoriasis. He was given thirty minute treatments once a week for a

year. The neck was red and thickened following these treatments but did not break down until two years ago.

A. Note the extent of the burn over the larynx and trachea. Over the cricoid cartilage is a deep ulcerated area lined by grayish-white necrotic membrane which was tightly adherent. This extends down to the cartilage. The surrounding tissue shows typical roentgen-ray changes. It is red, mottled and very hard and grips the larynx so tightly that it prevents movement. The burn is more intense in its central portion and becomes less deep at its margins. The voice is husky, the chin cannot be fully raised or the head turned, there is a sensation of tightness and at times intense pain. Internal examination shows that the mucous membrane of the larynx is reddened and there is slight thickening of the cords, but no ulceration.

B. The result after seven months. As complete an excision as possible of the burned area was done, and a double pedicled flap from the chest wall was shifted up to fill the defect. The ulceration extended to the cricoid cartilage but was removed with the entire burned area without breaking through. The sternocleidomastoid muscle on both sides was atrophied and changed into scar tissue. The area from which the flap was raised was snugged in and the remaining defect was grafted. Note the good condition of the flap and the complete take of the Ollier-Thiersch grafts on the chest wall. The pedicles have straightened out. The flap is soft and the result is entirely satisfactory.

A B

Fig. 10. Case x.

Comments on Burns of the Face and Neck

Cases I and II present a number of interesting points. In Case I, the skin was thin, easily irritated and contained very little pigment while in Case II, the skin was much more swarthy and leathery. Case I is a more difficult clinical problem than Case II as areas of keratosis with ulceration are con-

stantly appearing while in Case II, since the most seriously burned portions have been removed, the process seems at a standstill and the surrounding changed skin, so far, is in safe condition. Both of these patients had multiple roentgen-ray treatments. In Case II, the burn did not develop until a year after treatments had stopped. Case II was also later treated with ultraviolet rays but inasmuch as the tissue destruction had penetrated through the full thickness of the skin and into the subcutaneous tissues, this gave no permanent benefit. In Case I, the keratotic areas due to the roentgen-ray burn were treated a number of times with radium without benefit, and in fact these treatments seemed to stimulate the lesions to further activity. Both of these cases showed a wide area of tissue changes due to roentgen rays but on account of the location complete excision of all the involved skin was obviously impractical.

In Case I, the sections of the excised tissue from the left cheek showed neurosarcoma, but having seen very remarkable cell changes due to radiation treatments, I am inclined to believe that while the microscope may show sarcomatous changes this may be only a temporary picture and that later sections, if the tissue had not been removed, might have shown a very different picture, in fact might not have shown any malignant changes whatever. Furthermore if the tissue changes diagnosed as sarcomatous were really true sarcoma then the mortality of these particular cases would be considerably larger than it is. Sections in this case through other lesions which have developed in the neighborhood indicate no malignant degeneration. In Case II, the microscopic report from the tissue excised in a number of different areas is precancerous, but in no section was definite malignancy demonstrated.

I have observed that in those cases where sarcomatous changes are reported that the areas have usually been first burned by roentgen rays and later this burn has been aggravated by radium treatments

In lesions of the type illustrated by Case I, constant vigilance should be exercised and ulcerated areas and keratotic patches should be treated promptly and radically. In a case of the type of Case II, the only chance of permanent relief is the excision of the areas of keratosis and ulceration as they develop, with grafting of the defects thus made. In both of these cases following the operative procedures, there was distinct improvement in the comfort of the patient and also improvement in the condition of the tissues surrounding the operated area. Ollier-Thiersch grafts were successfully used to cover the defects left by the excision of the deeply burned areas in both of these cases.

Case III illustrates the destructive effect which radium may have on highly vascular tissue. The burn occurred during the treatment of a hemangioma of the cheek. This destruction involved the bone, and subsequently when healing took place dense scar formed which obliterated the buccal sulcus, above and below, on the right side. There was much discomfort and almost complete loss of function. The problem was to remove the burned tissue on the cheek, reconstruct this area with normal tissue, to line the cheek and make it possible to open the mouth. This was accomplished by the use of tubed flap with the utilization of the entire tube.

Case IV is interesting in that there were multiple roentgen-ray treatments given during childhood for an infection of the cheek, and illustrates the inhibitory effect of roentgen rays on growing tissues, as there is marked asymmetry of the face and flattening of the cheek and lower jaw on the side treated. In a case of this type, the burned area could probably have been excised and the defect grafted, although the tissues of the cheek were very thin, or better still, a flap could have been used. However, it seemed advisable to try gradual partial excision as it promised a better permanent result with less deformity. This was done, and the burned area was eventually excised. On account of the atrophy and

non-development of the tissues due to the roentgen-ray treatments, it became necessary to attempt to fill out this area, and this was easily done by the transplantation of a fat and fascia graft. A case of this type calls attention to the fact that roentgen rays and also radium may interfere with the development of a part during the growing period and also may cause atrophy in fully developed tissues.

Cases v and vi illustrate the destructive effect which radium may have when used therapeutically. It is possible in these cases that tissue changes caused by earlier treatment with roentgen rays may have made the radium more destructive. However, the fact remains that the final destruction was by radium. In both of these cases, it is very probable that a minor operation under a local anesthetic with removal by cautery knife, or even desiccation of the original growth would have cured the lesions with little or no deformity.

A destructive burn by radium occurred during the treatment of exophthalmic goiter in Case vii. Radical surgery would have been more efficacious and less dangerous in such a case than the simpler method of treatment with radium. A partially successful attempt was made to reconstruct the cartilaginous defects by the use of costal cartilage and skin flaps. The patient left the hospital before the reconstruction was complete with a very small opening remaining and has not returned for further treatment.

The roentgen-ray burns in Cases viii, ix and x followed multiple treatments for the removal of superfluous hair on the face and neck; for tuberculous glands of the neck, and for psoriasis, respectively. The treatment of Case viii was by gradual partial excision with closure. The treatment of Case ix was by excision of the burned area and filling the defect thus made with a single pedicled flap. The treatment of Case x was to excise the burned area and fill the defect thus made with a double pedicled flap.

The results in all of these cases have been very satisfactory. The relief of pain and discomfort, the restoration of function and the improvement in the general and mental condition of the patients has been most marked.

Radiation Burns of the Trunk

Fig. 11. Illustrating a burn following the use of roentgen rays in the postoperative treatment of carcinoma of the breast.

Case xii. The patient is forty-two years old. When thirty-five years old, the left breast was removed for carcinoma. Two weeks later when healing was complete roentgen-ray treatment was started and was carried on for three years, at first twice a week and later once a week. A burn developed and she has had much pain.

A. Shows the extent of the burn involving the chest wall, arm and axilla. There was atrophy, telangiectasis, ulceration and all the signs of a typical roentgen-ray burn. The changed tissue was tightly adherent to the chest wall and gives the impression of involving the ribs.

B. *Treatment.* The entire area was excised and great difficulty was encountered in separating the tightly adherent tissue from the ribs. A skin flap was pushed in to form the axilla and was anchored. Note the size of the denuded area. The photograph was taken nineteen days after excision and the granulations are ready for grafting except for one patch directly over the ribs where the roentgen-ray changes have involved the ribs and intercostal muscles. Small deep grafts were transplanted with success and the patient was discharged practically healed. Having lost track of this patient, I am unable to say what happened eventually.

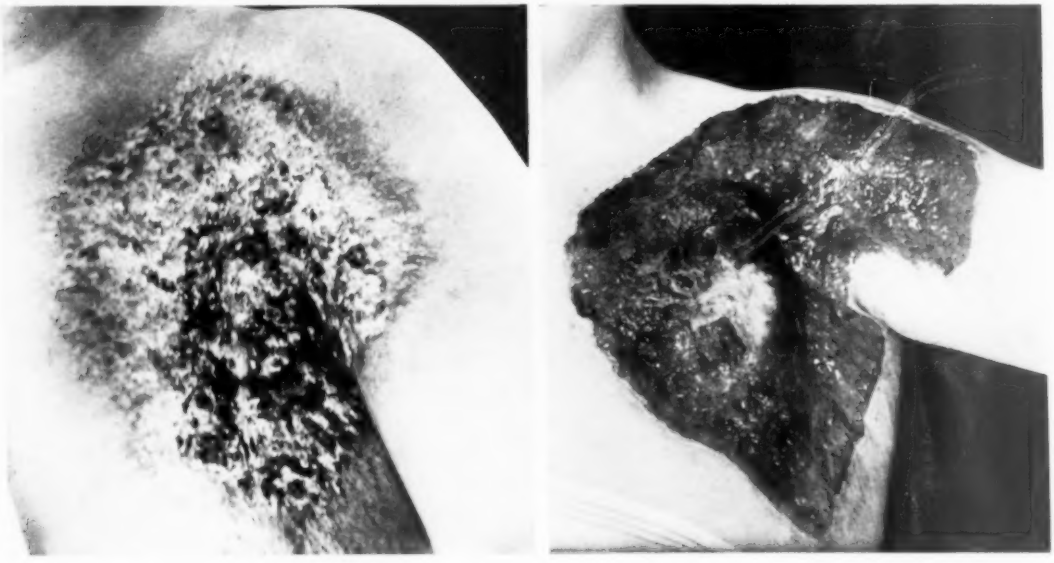
Fig. 12. Illustrating a roentgen-ray burn following exposures for kidney plates.

Case xiii. A man, forty-seven years old, was given three exposures for kidney plates, in 1904. He was burned and treated for the burn at the time. The ulceration healed and then broke down. It stayed healed a number of years and then broke down again and would not heal. Recently there has been much pain and discomfort. Examination thirteen years after the original burn shows a typical roentgen-ray burn with atrophy, telangiectasis, keratosis and ulceration. *Treatment.* This area was excised as completely as possible and two weeks later was

successfully grafted with small deep grafts. During the fourteen years which have elapsed since then, there has been no further trouble.

Fig. 13. Illustrating roentgen-ray burns of the abdominal wall following treatments for intra-abdominal conditions.

A. Case xiv. The patient, a young man, aged twenty-nine, had been given over a period of several years more than two hundred roentgen treatments for tuberculosis of the intestines. This left a definitely burned area in the right lower quadrant of the abdominal wall. About eighteen months before admission the burned area ulcerated and since then there has been intense pain. Infra-red rays have been used as well as other local measures without success. Typical roentgen-ray changes with ulceration can be seen. *Treatment.* This changed area was excised with a wide margin. A part of the changed tissues extended through the entire thickness of the abdominal wall including the muscles and it was inadvisable to excise all of it on account of weakening of the wall. Immediate grafting could not be done as the tissues were unfit to graft on account of poor circulation. However, after granulations formed, the wound was healed with small deep grafts. The patient has had no further trouble during the four years which have elapsed since discharge.



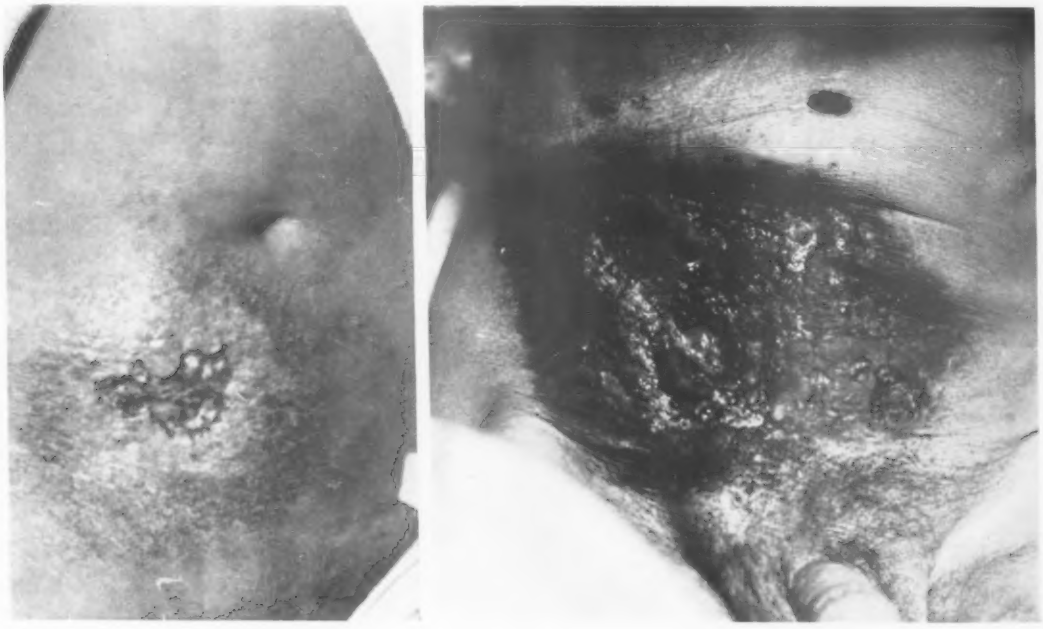
A B

Fig. 11. Case xii.

Fig 12 Case xiii

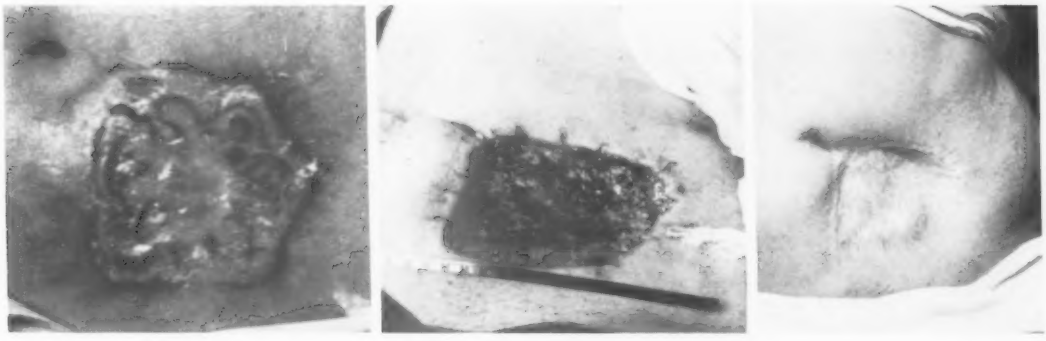
B. Case xv. The patient, a man aged fifty-five, had been operated on for carcinoma of the cecum and all of the growth could not be removed. He was given thirty-eight roentgen treatments and a severe burn followed. The photograph shows the extent of the burn. There was constant, exquisite pain. There was extensive deep ulceration and all the typical changes due to roentgen rays. *Treatment.* The entire area was excised with a good lateral margin, but as the changes extended through the full thickness of the abdominal wall all of its depth could not be removed. A chance was

taken and immediate Ollier-Thiersch grafts were applied. The wound was entirely healed within six weeks, but the patient died with metastases a few months later. It is interesting that after excision of the burned area the pain completely disappeared and did not recur.



A B

Fig. 13. Cases xiv and xv.



A B C

Fig. 14. Case xvi.

Fig. 14. Illustrating a roentgen-ray burn following the treatment of uterine myoma through the abdominal wall.

Case xvi. The patient, a woman aged forty-five, was given elsewhere several roentgen treatments for myoma of the uterus. A severe burn followed with a history of intense pain and continuous ulceration.

A. The burned area occupies a large portion of the lower left quadrant of the abdominal wall. Its outline is very irregular and its central portion is occupied by an ulcer with very irregular outline and thickened curled edges. A dense adherent, necrotic slough covered a considerable portion of the floor of the ulcer. The patient was stout and the abdominal wall was very thick.

B. *Treatment.* The burned area was excised as completely as possible, the markedly changed

tissues extended to the muscles which were partly infiltrated with scar. This left a very deep crater. A wedge-shaped piece of fat was removed subcutaneously all around the defect and the skin edges were brought down and sutured to the floor of the wound, thus making subsequent grafting more simple. The condition of the tissues was not suitable for immediate grafting so the wound was allowed to granulate.

Pain ceased immediately after excision of the burn. Twelve days later small deep grafts were transplanted on undisturbed granulations and were successful. The patient was discharged healed, three weeks later.

burned area involves the penis, scrotum, pubis, groin and upper inner portion of the right thigh. There are patches of ulceration on all of these areas. The penis is badly deformed by scar and ulceration.

B. *Treatment.* The changed tissues were excised as completely as possible. The photograph gives an idea of the size of the excised area and shows the partial take of an Ollier-Thiersch graft.

C. The original Ollier-Thiersch graft was supplemented by small deep grafts and a plastic was done on the penis, using the prepuce to cover the ulcerated area on the right side of the shaft. The photograph was taken at time of

A B C

Fig. 15. Case xvii.

C. Shows the grafted area after five years. The tissues are soft and movable. There is no sign of further trouble and there has been no pain since operation. The patient has been carrying on a very active outdoor life since leaving the hospital.

Fig. 15. Illustrating a severe roentgen-ray burn following a single treatment.

Case xvii. The patient had tuberculous epididymitis and after removal of testicles, eighteen months before admission, was given a single treatment with roentgen rays. A severe burn followed and the area treated would heal and break down and repeat this process. Seven months ago the burned area broke down and has not completely healed since. There is intense pain, difficulty in walking and a marked mental depression, and the general condition is very poor.

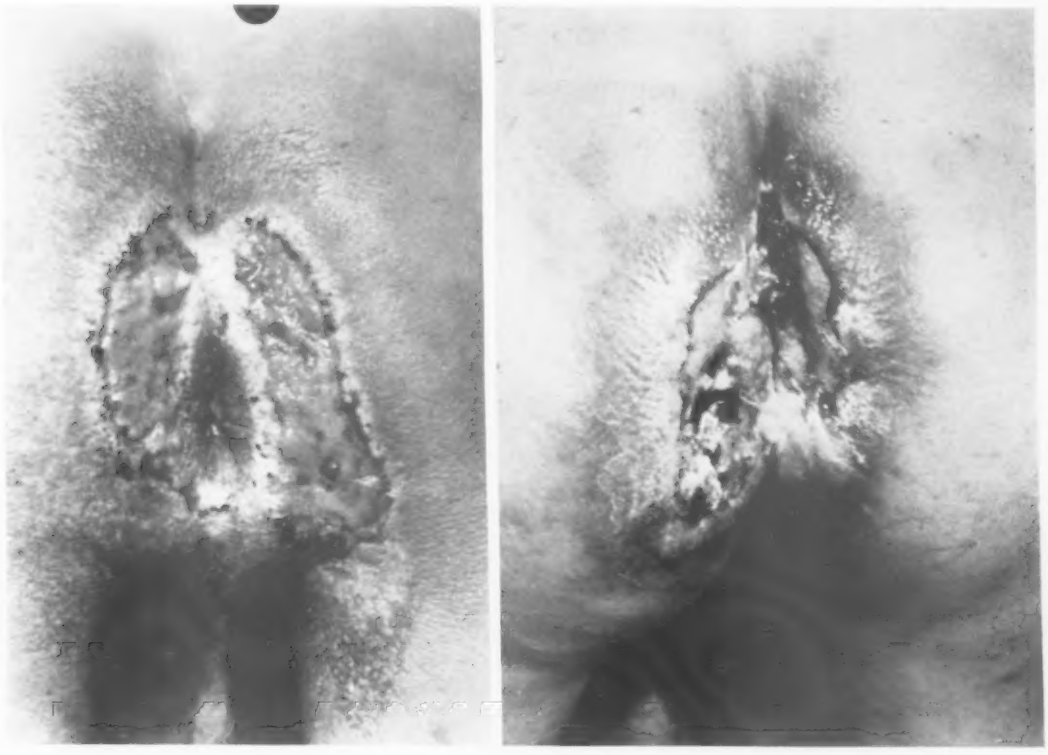
A. Shows the condition on admission. The

discharge, just two months after the origina excision was done. The patient was comfortable and much improved in every way. The following year death occurred from some intercurrent trouble.

Fig. 16. Illustrating roentgen-ray burns of the buttocks and anus.

A. Case xviii. Shows an extensive radiation burn of the buttocks and anus following several treatments with roentgen rays for pruritus ani. The skin of the anus was ulcerated and very painful, and the tissues changed by the treatments can be seen extending to buttocks and scrotum. There is constant intense itching and discomfort. The patient, a stone mason, aged sixty-four, is unable to work. *Treatment.* The entire affected area was excised and after granulations formed and were in good condition, small deep grafts were applied. He was discharged completely healed after one month.

Seven years have elapsed since the grafts were applied. The patient has been comfortable and able to resume his occupation. No breakdown has occurred.



A B

Fig. 16. Cases xviii and xix.

A B C

Fig. 17. Case xx.

B. Case xix. This severe roentgen-ray burn followed several treatments for prostatic hypertrophy. Note the deep destruction of tissue. The hypertrophy of the prostate may have been benefited but the result of treatment is many times worse than the original condition. *Treatment.* The burned area was excised as completely as possible and the defect was grafted with small deep grafts and this process was continued as granulations became suitable until almost complete healing was obtained and the patient left the hospital.

Fig. 17. Illustrating the use of small deep grafts in healing defects left after excision of a roentgen-ray burn.

CASE XX. The patient suffered with pruritus ani and vaginae and fifteen years before admission had several treatments with roentgen rays. Twelve years later the irradiated tissues began to break down. Various types of treatment, including more roentgen irradiation, were tried without success. Pain, tightness and intense itching, with discharge from broken down areas are the symptoms at time of admission.

A. Shows typical roentgen-ray burn around the anus on buttocks and labiae. There is ulceration on both buttocks and along the labiae on both sides. The skin changes are typical. A narrow rim of skin immediately around the anal opening was in fair condition.

B. *Treatment.* The changed tissue on the labiae and across the fourchette was excised in one horseshoe-shaped piece and on account of the laxity of the tissues, the edges were sutured and per primam healing followed. The areas on both buttocks were excised but the circulation of the tissues was so poor that immediate grafting could not be done. The photograph gives an idea of the size of the excised areas with the granulation tissue nearly ready for grafting. The patient was discharged completely healed five weeks after grafting.

C. The photograph shows the result after four months. Healing is complete, there is normal function; there is no pain and there has been no discomfort of any sort for several years.

Fig. 18. Illustrating the use of bilateral double pedicled delayed transfer flaps for the relief of a roentgen-ray burn of the anus and buttocks.

CASE XXI. A man, aged thirty-six, had multiple treatments with roentgen rays for pruritus ani, beginning fifteen years before admission, and these treatments were continued off and on for several years. He has also had ultraviolet treatment and innumerable local treatments of various kinds. The affected area broke down three years ago and has not healed since that time. There is much pain and intolerable itching.

A. Shows the ulcerated, keratotic condition involving the anus, and radiation changes in the surrounding tissues for a distance of 2 to 3 inches.

B. *Treatment.* Inasmuch as the skin of the anus was involved and had to be removed some method must be used to replace this with skin whose circulation could be assured during its transfer. In this case, it seemed advisable to use bilateral double pedicled delayed transfer flaps, from comparatively normal skin, as giving the most hopeful prognosis.

Note the suture lines showing the flaps which had been completely undercut from pedicle to pedicle and then were replaced and sutured.

C. After two weeks these flaps were again raised, the burned tissue around the anus was excised and the flaps were shifted inward and drawn down into the crease between the buttocks, and sutured to the anal margin and to each other above and below the anus. The photograph was taken three weeks after the flaps were shifted inward. Note the granulating defects from which the flaps were shifted. These defects were later grafted with small deep grafts.

D. Shows the complete work after six months. The patient has had no further trouble during the eighteen months which have elapsed since operation. The bowels are functioning normally, all discomfort has disappeared and a normal life can now be lived. Note the normal skin running to the anal margins.

COMMENTS ON BURNS OF THE TRUNK

Case XII was chosen to illustrate what may happen following the overzealous postoperative use of roentgen rays. In this case no malignant changes were found in the excised tissues.

Case XIII illustrates a condition not seen very frequently in these days of short exposures for taking plates. Three exposures of fifteen to twenty minutes each were given while taking kidney plates and a burn resulted. Healing finally occurred and the area remained healed for fourteen years, after which ulceration developed which would not heal, and this was accompanied by intense pain. Irritation of some sort may have caused the breakdown, but slow obliterative endarteritis was probably also a factor.

In Cases XIV and XV, the abdominal walls of both patients were burned with

roentgen rays during the treatment of intra-abdominal conditions. Both of these burns were deep, involving the abdominal muscles, and in Case XV, the full thickness were no malignant changes in the burned tissues.

In Case XVI, the burn occurred following several treatments with roentgen rays for

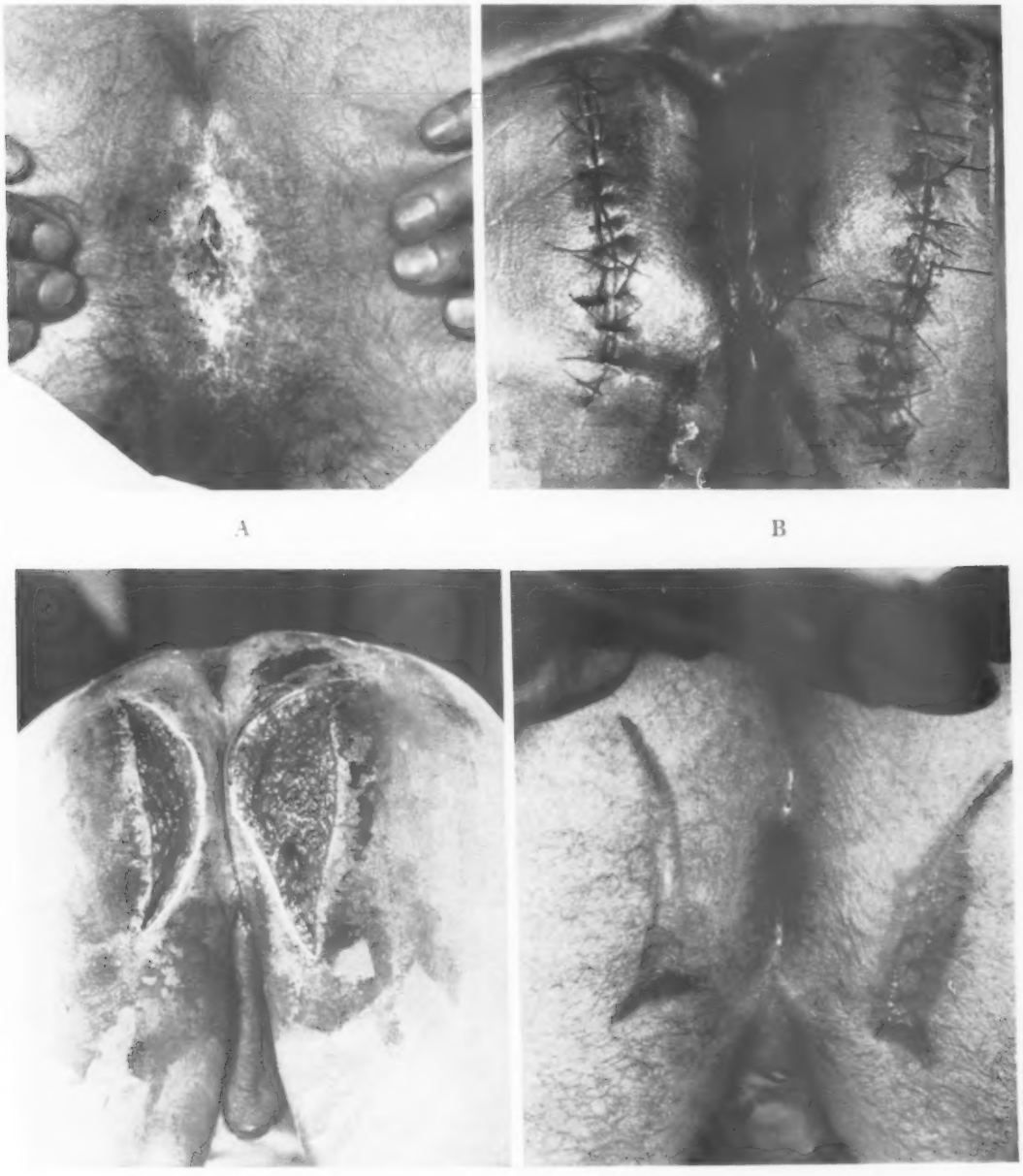


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FIG. 18. CASE XXI.

of the abdominal wall was involved. In Case XIV, small deep grafts and in Case XV, Ollier-Thiersch grafts were used to induce healing in the defects after excision. There an intra-abdominal condition. In this case the margins of the burn were quite sharply differentiated. Intense pain and prostration followed. Relief was obtained by complete

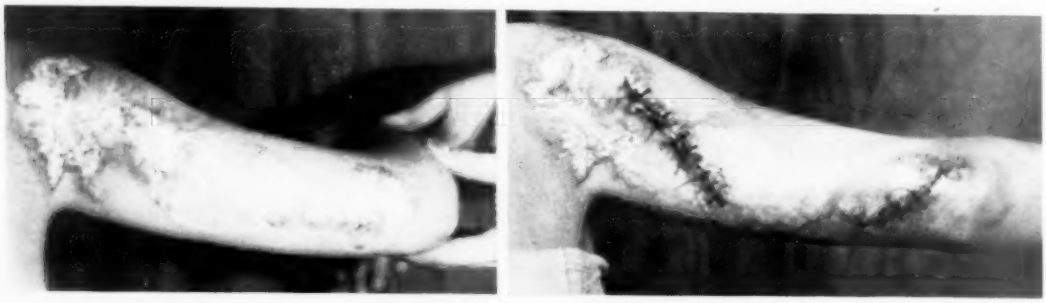
excision of the burned area and healing was induced with small deep grafts.

Case XVII shows a roentgen-ray burn caused by a single treatment given for tuberculous epididymitis and illustrates the destructive action of the rays. The pain was intense in this case and mental depression was most marked. Following excision the pain ceased, the mental condition improved and in the months before his death there was comfort as far as the burned area was concerned.

Case XVIII and XIX illustrate roentgen-ray burns of the anus and buttocks following treatments for pruritus ani, and hypertrophy of the prostate respectively. The destruction of tissue was much more marked in Case XIX but the pain and itching were so intense in Case XVIII that there was little to choose as far as symptoms were concerned.

In Case XX, the patient was burned with roentgen rays following treatments for pruritus ani and labiae. After twelve years the burned tissues ulcerated and pain and itching became intense. Excision of the area followed by grafting with small deep grafts induced prompt healing. Small deep grafts are the type which offer the most likely prospect of healing in such regions as we are dealing with in this case. During the three years which have elapsed since operation, there has been no trouble whatever. In cases of this kind and in fact in all roentgen-ray burns the skin surrounding the grafted areas should be observed from time to time as progressive changes may take place, signs of which were not apparent at time of operation.

In Case XXI, roentgen treatments for pruritus ani were begun fifteen years before admission and were continued, off and on, in addition to various other treatments. A burn developed which has given the patient continuous trouble. There is intense pain and intolerable itching. As there is involvement of the anal skin as well as that surrounding the anus and as it would be impossible to expect a graft to take, in this situation, unless the bowel was sidetracked above, it was necessary to have skin with assured circulation while it was healing in its new location. To secure this condition, double pedicled delayed transfer flaps were used. A satisfactory result followed and the patient is leading a normal life without pain or itching.



A B

FIG. 19. CASE XXII.

RADIATION BURNS OF THE EXTREMITIES

Fig. 19. Illustrating the treatment of a radium burn of the arm by gradual partial excision.

CASE XXII. A twelve year old girl was burned with fire on the arm four and a half years ago. A thickened keloidal scar developed and this was treated two years ago several times with radium. The scar was flattened considerably but typical radium changes developed in several areas.

A. In this case massage was advised and after one year the patient returned with the scar much improved as to softening and movability, but with no improvement in the areas changed by radium. Gradual partial excision was decided on.

B. Shows the result after ten days of the first step of gradual partial excision. Two of the most seriously changed areas were removed and the edges were sutured. Further excisions will be made as the skin stretches, and it is probable that in time practically all of the changed tissue can be thus removed.

Fig. 20. Illustrating an acute radium burn followed by infection.

Case xxiii. The patient was treated with radium twice for a wart on the forefinger. The treatments were two months apart and a burn followed the second treatment. This burn was subsequently treated several times with ultraviolet rays and the condition aggravated. Infection followed. Amputation subsequently became necessary.

Fig. 21. Illustrating a roentgen-ray burn caused by overexposure under the roentgenoscope.

Case xxiv. A physician burned his hand while using the roentgenoscope in locating a foreign body in the hand of a patient. It is an interesting fact that his patient was also severely burned at the same time. There was intense pain and complete loss of function. The ulceration occurred a short time after the exposure and had not healed. Note the skin of the fingers showing different stages of roentgen-ray changes. The nails of all the fingers are ridged, rough and brittle. The skin is dry, hairless, blotchy and cracks easily. There are beginning patches of keratosis in several areas. The skin on the back of the hand is also changed but not as markedly as on the fingers. Further progress of the condition can be expected on the fore and ring fingers.

Fig. 20. Case xxiii.

Fig. 21. Case xxiv.

Treatment. The ulcerated area on the middle finger was excised as completely as possible, and the defect was covered successfully by a pedunculated flap from the abdominal wall. Restoration of function followed. Six months later the patient returned with intractable painful ulcers of the fore and ring fingers. These were also excised and the defects were covered with a gauntlet flap from the abdominal wall. A good result was obtained and the patient has been able to carry on his work for the four years since discharge from the hospital.

Fig. 22. Illustrating the use of a single pedicled flap in the treatment of a roentgen-ray burn of the finger.

Case xxv. Eight months before admission a physician was using a roentgenoscope, and overexposed his hand during the removal of a foreign body. Several weeks later, a burn developed. He has had different types of treatment without result. Two weeks ago a deep ulcer formed, and there is intense pain. There are radiation changes on the other fingers also, but especially marked on the middle finger.

A. The photograph shows typical roentgen-ray ulceration of dorsum of the terminal pha-

lanx of the left forefinger with other changes on the rest of the finger and on adjacent fingers.

B. *Treatment.* The ulcer was excised and the defect was successfully covered with a single pedicled, immediate transfer, flap from the chest wall.

C. The result was good and function was restored. Nine months later, the patient returned for treatment of the middle finger which had broken down and was very painful. This area was excised and the defect immediately covered by a half thickness graft, although the surface was not particularly favorable. The graft took and finally the wound healed and good function followed.

A B C

FIG. 22. CASE XXV.

A B C

FIG. 23. CASE XXVI.

Fig. 23. Illustrating the necessity of amputation and the use of a gauntlet flap in treating roentgen-ray burns of the hand.

CASE XXVI. Nine months before admission, the patient, a physician, while removing a piece of steel from the hand of a patient was exposed under the roentgenoscope for about ten minutes. Two weeks later he removed a needle from another patient's hand and was exposed this time about five minutes. His hands became very red and he was treated for erythema and later for lupus erythematosus. About one month before he came under my care the correct diagnosis of roentgen-ray burn was made. The dorsum of the middle finger of the left hand was ulcerated and the tendon exposed. The skin of the rest of the finger was also involved. The finger was rigid and function was completely lacking, and pain was intense. There were roentgen-ray changes of the other fingers also, especially the ring finger which will probably break down. Inasmuch as there was

no chance of making a useful finger, amputation was advised for the middle finger and this was done elsewhere.

A. The patient returned two months later with the condition shown in the photograph. The middle finger had been amputated in the meantime. Marked ulceration of the ring finger had occurred during the two months' absence and also ulceration of a lesser degree of the forefinger.

B. *Treatment.* On account of the depth of the ulceration on the ring finger a gauntlet flap was used to cover the defect made by the excision of the ulcer while the defect on the index finger left by the excision of the ulcer was covered with a measured half thickness graft.

C. Both of these procedures were successful and the patient has been able to resume his practice with comfort.

Fig. 24. Illustrating bilateral roentgen-ray burns of the hands.

Case xxvii. The patient was treated for eczema of the palms of the hands with roentgen rays several years before admission and came in on account of pain, loss of function, general discomfort and increasing intensity of the symptoms.

A. Right hand. The skin of the entire hand, front and back, has been affected by the rays and shows typical changes especially marked over the palm and palmar surface of the fingers where there is atrophy, keratosis, telangiectasis and ulceration. The skin of the distal phalanges is still in fair condition but that of the rest of the palmar surface of the fingers is so much involved that excision will be necessary. The fingers and thumb cannot be fully extended.

Treatment. The involved tissue on the palm fingers and thumb was removed as completely as possible, and the defect was covered by a measured delayed transfer single pedicled flap from the abdominal wall. The left hand is much the same as the right except the involvement is not quite so marked.

Treatment. Eighteen months after the transplantation of the abdominal flap on the right hand, it was determined, after excision of the changed tissues on palm and fingers of the left hand to try a measured whole thickness graft. This was done but unfortunately a hematoma collected under the palmar portion of the graft and a large area sloughed. After granulations were formed this area was grafted with small deep grafts.

A B

Fig. 24. Case xxvii.

B. Shows the result of the transplantation of the flap on the right hand after three years. The palm and proximal portions of the fingers and thumb are covered with a soft resistant pad of whole thickness skin and fat. Function is much improved and the fingers can be flexed and can be almost completely extended. By relaxing the short webs between the fingers and between the thumb and palm much more motion can be secured, and this has been successfully carried out within the last few weeks.

The result following the use of small deep grafts on the granulations of the palm of the left hand after eighteen months and the successful portions of the whole thickness graft on the thumb, thenar eminence and fingers can

also be seen. As a rule, the use of small deep grafts is not to be recommended on the palm on account of possible subsequent contraction, but in this case it seemed the best solution of the problem and has turned out happily. There is no pain, function has been restored and the hand can be used quite normally.

Fig. 25. Illustrating the destructive effect of exposure under a roentgenoscope followed by two subsequent exposures to roentgen rays.

Case xxviii. The patient was badly burned under a roentgenoscope during the removal of a foreign body from the hand. There were two subsequent exposures to roentgen rays which aggravated the condition.

A B

Fig. 25. Case xxviii.

A. Note the great destruction of tissue which includes most of the extensor tendons. Some of the slough had been removed, elsewhere, before admission. There was intense pain and complete loss of function. There was extensive ulceration and the edges of the ulcer were thickened and hard.

B. The result of the transplantation of a pedunculated delayed transfer flap from the abdominal wall, at the time of discharge. Considerable subsequent improvement can be made as there is a good pad of skin and fat on the back of the hand, which will prevent further over-extension of the fingers. Following the excision of the ulcer the patient had relief from pain, and a fairly useful hand.

Fig. 26. Illustrating a radiation burn with malignant degeneration.

Case xxix. The patient received roentgen treatment for eczema twenty years ago. The eczema was improved, but telangiectases and other changes remained, so ten years later radium treatments were given to remove the changes made by roentgen rays. A burn followed. The area broke down and has continued to heal and break down ever since. For some time, however, the ulcer has not healed and during the last month has become much aggravated.

A. The photograph gives an excellent idea of the cauliflower-like growth on the back of the hand surrounded by tissues changed by roentgen rays and radium. The lesion looked malignant. There were no glands palpable.

Treatment. The growth was completely excised with a cautery knife with a wide margin. After granulations had formed the defect was grafted with small deep grafts and healing promptly followed. Sections of the tissue removed showed sarcoma.

B. Shows the grafted area two years later. Function is completely restored and there is no sign of any further trouble. Five years have elapsed since operation and the patient is well and active. I feel that all of these excisions should be made in anticipation of malignancy.

Fig. 27. Illustrating the effect of numerous exposures to roentgen rays without adequate protection. Malignant degeneration.

Case xxx. The patient was a physician, who had used roentgen rays in his work for a period

A B

Fig. 26. Case xxix.

of eight years. On account of a burn of his skin, he avoided all exposures to roentgen rays during the ten years before admission. There has been an ulcer on the middle finger for the last five years, and during the last six months two other ulcers have developed on the back of the hand which will not heal. An unusual feature of this case is the fact that there has been little or no pain. The photograph shows marked involvement of the skin of the entire hand with atrophy, keratosis and multiple ulcerated areas. The appearance of the ulcers is very suspicious of malignancy.

Treatment. All of the ulcerated areas were excised as thoroughly as possible with the cautery. Frozen sections showed squamous cell carcinoma. The axillary glands were removed, although they were not palpable through very thick fat and all of them were found to be involved. After granulations had formed on the hand, small deep grafts were transplanted and the wounds were completely healed in three weeks. The patient died of generalized metastases after five years.

Fig. 27. Case xxx.

Fig. 28. Illustrating a roentgen-ray burn of the knee causing loss of function.

Case xxxi. The patient, a man aged thirty, had been treated a number of times with roent-

gen rays for eczema about eight years before admission. A burn followed and the area has healed and broken down, off and on, ever since. He is unable to flex the knee, has intense pain and is much incapacitated.

Fig. 29. Illustrating a roentgen-ray burn of the leg.

A B

FIG. 28. CASE XXXI.

A. Note the ulceration over the patella, the patches of keratosis, the telangiectases and typical roentgen-ray changes.

Treatment. The burned area was completely excised and the defect was grafted with a single whole thickness graft from the abdominal wall.

B. The graft two months after operation. Note the excellent condition of the transplanted skin. Function has been completely restored and the patient has been leading a normal life for the two years and a half which have elapsed since operation.

CASE XXXII. Two years ago the patient, aged forty-three, was given five treatments, a week apart, with roentgen rays for eczema of the leg, and a burn developed. The burned area was treated with ultraviolet rays.

A. The photograph shows an ulcer of considerable size in the midst of tissues typically changed by roentgen rays. The edges were hard and everted and being in the midst of this type of tissue and of considerable duration was

suspicious of malignancy. The glands in the groin were not enlarged. Complete excision was indicated.

Treatment. The ulcer with a very wide margin was excised and the excision extended down through the deep fascia. Immediate grafting of the defect with Ollier-Thiersch grafts was done. In five weeks the patient was discharged and soon resumed his work, which keeps him constantly on his feet. Microscopic examination showed no malignant degeneration.

B. The result after six months. Note the outline of the grafted area which gives an indication of the wide excision carried out. The healing is firm and stable. During the year which has elapsed since operation, the patient has been perfectly comfortable and is leading a normal life.

Fig. 30. Illustrating the progressive character of a roentgen-ray burn.

CASE XXXIII. The patient was treated with roentgen rays for eczema of the foot four years before admission and was burned. There was considerable discomfort, off and on, until several months ago when the burn became much more troublesome and ten days ago ulceration occurred and the area became very painful.

A B

FIG. 29. CASE XXXII.

A. The photograph shows the position of the ulceration and its character, with the change in the surrounding skin.

Treatment. The entire ulcerated area with a good margin was excised and although the circulation of the tissues in the defect thus made was not good, small deep grafts were transplanted immediately. The large majority of the original grafts were successful, but a few more grafts were used subsequently to fill in some minor defects.

B. Result after six weeks. During the six years which have elapsed since grafting, the

patient has had no further trouble and has been able to lead a very active life without pain.

Fig. 31. Illustrating a radium burn of the heel.

Case xxxiv. The patient was treated several times with radium for a callosity of the right heel and a definite radium burn developed causing pain and inability to walk.

A. There is keratosis, telangiectasis and ulceration.

Case xxxv. The patient had been burned during a roentgenoscopic examination some years previously and was incapacitated by pain and ulceration. At that time as large an area was excised as seemed justified by the radiation changes and a single pedicled immediate transfer flap was shifted from the opposite leg to fill the defect. The result was excellent and the patient was able to continue her life in comfort. About eight years after this, or nine years after the first exposure, further radiation changes began to appear above and below the flap. There was pain and increasing loss of function.

A B

Fig. 30. Case xxxiii.

Treatment. The area was excised completely and into the defect was sutured a measured whole thickness graft from the thigh. The graft took throughout.

B. The grafted area one year later. The graft is soft and stable. All symptoms are relieved and the patient can walk without discomfort and has resumed her occupation. In a weight-bearing area like the heel a graft of whole thickness is to be preferred to the thinner type.

Fig. 32. Illustrating the delayed appearance of a roentgen-ray burn of the foot.

A. On admission, the flap previously transplanted was soft and in excellent condition, but there were definite typical radiation changes from the anterior margin upward toward the toes and from the posterior edge of the flap backward toward the heel.

Treatment. On account of the acute pain and loss of function, these areas were excised and flaps from the opposite thigh were used to fill in the defects made by the excisions.

B. Shows the result four years later. The patient is comfortable and can walk normally. The new sole made up of three pads is soft and resistant and gives no trouble. The vertical crease which can be seen running along the center of the flaps is the impress of a stocking seam.

ent when admitted can be seen, with keratosis, ulceration and all the other radiation changes. There was intense pain and complete loss of function.

Treatment. As complete excision as possible was done. After the granulations were healthy small deep grafts were applied.

A B

Fig. 31. Case xxxiv.

Fig. 33. Illustrating a chronic roentgen-ray burn of the foot following multiple treatments for eczema.

Case xxxvi. A middle-aged woman with eczema of the foot had been treated a number of times with roentgen rays. A burn followed and this caused loss of function and intense pain. The patient was advised that radical treatment was necessary but procrastinated and tried numerous other methods of treatment for several years including more roentgen rays.

A. The frightful condition which was present when admitted can be seen, with keratosis, ulceration and all the other radiation changes. There was intense pain and complete loss of function.

B–C. Shows the extent of the area excised and the grafts eight days later. The patient was discharged in nine weeks completely healed and able to walk.

D. Result nine months later after grafting with small deep grafts. The patient has been able to walk with comfort for the first time in years.

Two years later, the patient returned to the hospital as keratosis had developed on the heel behind the grafted area. The surface originally grafted was in excellent condition.

Treatment. The skin of the rest of the heel

was excised and covered with a very thick Ollier-Thiersch graft which was successful. Two years have elapsed since the last grafting and the patient is without pain and is walking quite comfortably.

Fig. 34. Illustrating bilateral roentgen-ray burns of the feet following treatments for psoriasis.

C–D. The grafted area after five months. The healing is stable, the grafts are soft. More than a year has elapsed since discharge from the hospital and the patient is walking about without pain.

Fig. 35. Illustrating bilateral roentgen-ray burns of the feet following postoperative treatments.

A B

Fig. 32. Case xxxv.

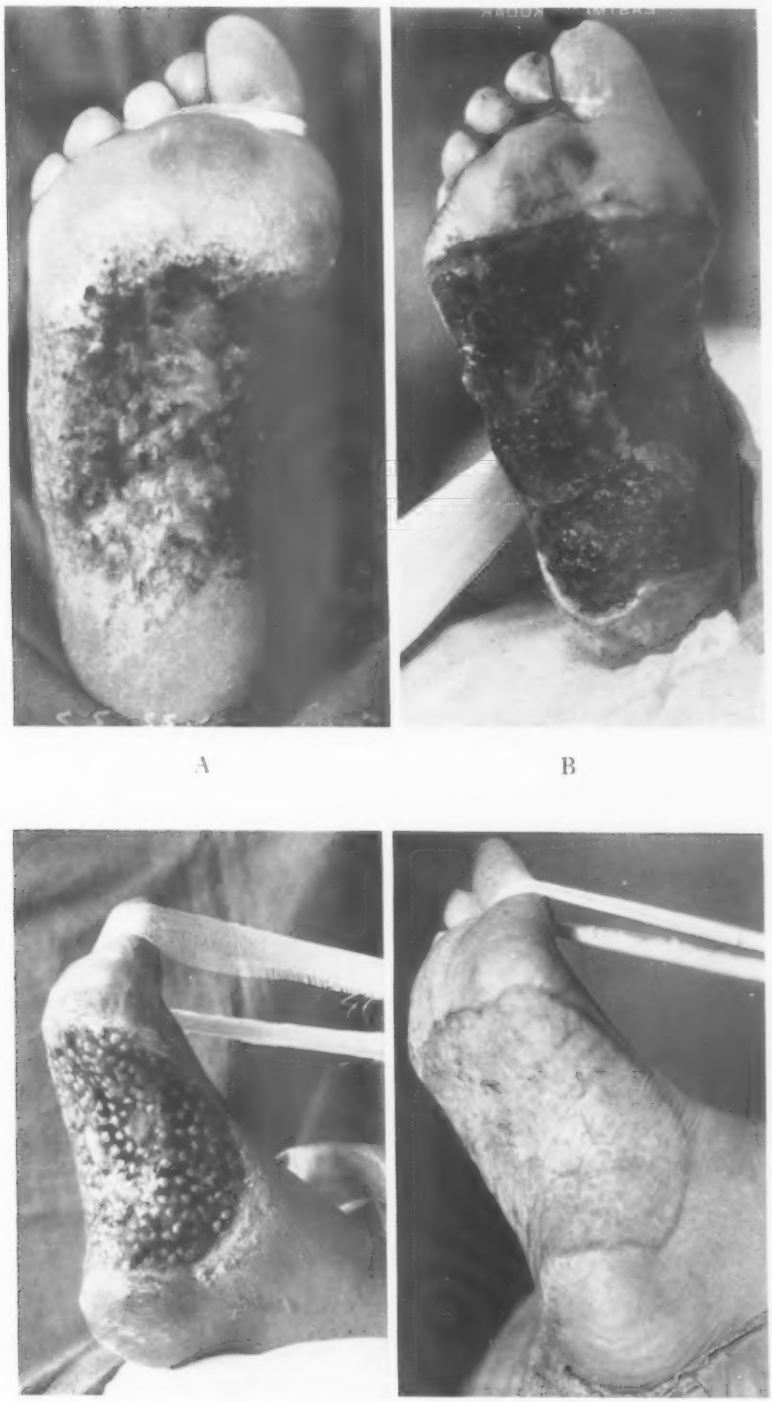
Case xxxvii. The patient was given a number of roentgen treatments for psoriasis and was burned. Subsequently she was treated with ultraviolet rays and numerous local applications. She was practically bed-ridden and suffered constant intense pain.

A–B. The photographs give an idea of the character of the burn with telangiectases, atrophy of the skin, keratosis, fissures and ulcers.

Treatment. The changed areas on both feet were excised as completely as possible. A chance was taken on immediate grafting with thick Ollier-Thiersch grafts from the thighs.

Case xxxviii. The patient, a man aged twenty-one, gives a history of having had bilateral fibrosarcomata on the soles of the feet, which were removed five years before admission. Postoperative roentgen treatments were given after the removal of the growths. A year and a half later the soles of both feet ulcerated and then were healed with difficulty in the course of a year. He was unable to walk except on his toes. At present, there is pain, inability to walk comfortably.

A–B. There is ulceration in the midst of tissues changed by roentgen rays on the soles of



A B C D

Fig. 33. Case xxxvi.

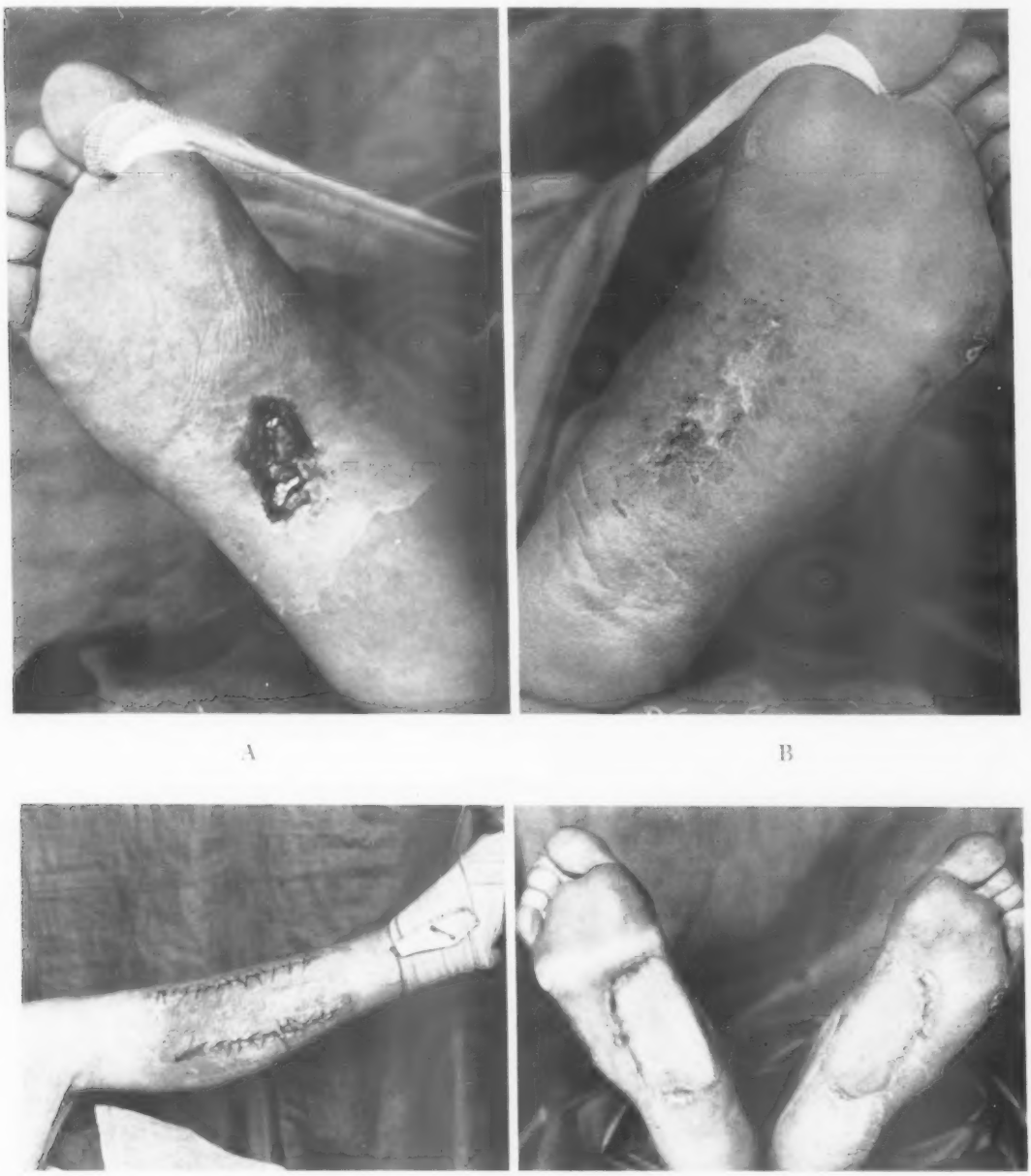
A B C D

Fig. 34. Case xxxvii.

both feet. There is keratosis and superficial ulceration with markedly changed tissues around it.

C. Shows the type of delayed transfer flap raised from the opposite leg.

D. Shows the flaps of skin and subcutaneous



A B C D

Fig. 35. Case xxxviii

Treatment. These areas were finally excised and after several unsuccessful attempts with skin grafts, it was determined to fill the defects with delayed transfer pedunculated flaps, each from the opposite leg.

fat filling the defects made by excising the burned area. The photograph was taken ten months after discharge. The patient can walk comfortably, has no pain and is able to resume his occupation which keeps him on his feet for

eight hours a day. The condition should continue to improve as the tissues readjust themselves, as the effect of years of pain and unusual posture have to be overcome, and this takes time.

COMMENTS ON BURNS OF THE EXTREMITIES

The treatment of keloid or of thickened keloidal scar with radium or roentgen rays is frequently followed by telangiectases, tissue changes and burns, and these burns must be treated radically. Otherwise, in the course of time, keratosis and ulceration will probably follow. This is illustrated in Case XXII.

Ordinary finger warts are often treated with radium. Sometimes an acute burn will follow as illustrated in Case XXIII. In this instance amputation of the finger was necessary in order to save the hand.

All of these patients were physicians (Cases XXIV, XXV and XXVI) and all of these were burned by exposures under the roentgenoscope. Different types of ulceration are shown in these three cases and different stages in the roentgen changes in the skin of the hand. In Case XXVI, amputation of one finger was necessary on account of the impossibility of restoring function. In all there was intense pain and in all it was necessary for them to return for secondary operations as the progressive degeneration of the skin of other fingers occurred. Pedunculated flaps were used on all of these patients after excision of the burned area and in addition skin grafts of half thickness were used on other excised areas. These cases indicate the necessity of protection of the hands of the operator, especially when working under the roentgenoscope. I have had a great many similar cases, practically all of them occurring in doctors and dentists.

The burns in Case XXVII followed roentgen-ray treatments for eczema and caused almost complete incapacity. These burns were deep and after as complete excision of the changed tissues as possible which exposed the deep vascular arches and tendon sheaths a measured pedunculated flap was used to cover the right palm and proximal phalanges. The result was satisfactory except that the commissures were much more shallow than normal so that the fingers could not be fully spread apart. Subsequently the burned area on the left hand was excised in the same way but instead of a flap a whole thickness skin graft was transplanted to cover the defect on palm and fingers. In spite of every care in checking hemorrhage a hematoma formed in the palm and that portion of the graft sloughed. Then after granulations formed, small deep grafts were applied and prompt healing followed. A comparison of the results obtained on these hands show a much softer and thicker pad on the right, which was covered by a flap but an equally satisfactory healing and restoration of function on the left, although small deep grafts were used. These small deep grafts, it must be remembered, in many instances include the full thickness of the skin at the central portion and all include a generous thickness of corium in varying thicknesses. No such result could have been obtained with a true Reverdin graft which includes the epidermis and as thin a piece of corium as can be cut.

Case XXVIII illustrates the destruction which may follow a burn from a roentgenoscope. There was great pain and total loss of function. Inasmuch as the extensor tendons were destroyed these must be reconstructed before much change in function could be expected, but in the meantime something should be done after excision of the burned area to cover the defect with a pad of skin and fat to prevent further deformity and to give a base for further reconstructive work. This was done with a delayed transfer pedunculated flap from the abdominal wall. This patient has not returned for the completion of the work, but has been comfortable during the four years which have elapsed since operation and has a fairly useful hand with no exaggeration of the deformity.

Cases XXIX and XXX are interesting in that they both show chronic ulceration on

the hand due to radiation burns. Case XXIX was treated a number of times with roentgen rays for eczema which was followed by tissue changes, and ten years later with radium. Case XXX was burned by multiple exposures with roentgen rays in the course of his professional work over a period of eight years. In Case XXIX the microscopic findings were sarcoma and the patient is still alive and perfectly well after five years with no sign of metastases, although the axillary glands which were not palpable, were not removed. In Case XXX the ulcerated areas showed squamous cell carcinoma. The glands were not palpable in this case, but were removed and each one of them was involved. This patient died five years later with generalized carcinoma. In this case the process must have extended beyond the glands before the operation although there were no signs of extension which could be seen. The excisions in both of these cases was with the cautery with a wide margin and as deep as could be safely done. Both were healed, after granulations had formed, with small deep grafts.

In Case XXXI there was complete loss of motion of the knee following a roentgen-ray burn. After excision, a single measured graft of whole thickness skin was transplanted and after healing was complete, gradual restoration of complete function occurred. In Case XXXII after excision of the area burned by roentgen rays, including the deep fascia, the defect was successfully covered with Ollier-Thiersch grafts. In this case thin grafts were used as there was soft tissue beneath. In Case XXXI, it was necessary to use a graft of whole thickness as there is naturally more trauma over the knee and thicker skin gives a more stable healing. Both of these patients had been treated for eczema. Both burns were of considerable duration. In neither was there malignant degeneration found in the tissue removed. In both there was complete restoration of function and ability to continue their daily occupation.

In Case XXXIII, a roentgen-ray burn followed treatments for eczema and in Case XXXIV a radium burn followed treatment for callosity on the heel. There was pain and loss of function in both instances. Immediate small deep grafts were used in Case XXXIII and a single whole thickness immediate graft was used in Case XXXIV. Both were successful and relief of pain and restoration of function followed. The sections showed no malignant changes.

Case XXXV illustrates the delayed appearance of roentgen-ray burns which is quite typical. The patient was burned on the bottom of the foot. The burned portion was excised as widely as seemed necessary and a pedunculated flap from the other leg was used to fill the defect. All was comfortable for eight years. Then typical radiation changes gradually appeared on the sole of the foot, above and below the flap. Pain and inability to walk followed. The delayed development of tissue changes, in tissues which had seemed quite normal at the time of first operation is interesting and can be accounted for only by slow progressive obliterative endarteritis.

Cases XXXVI, XXXVII and XXXVIII are used to illustrate the types of severe and crippling roentgen-ray burns of the feet which are frequently seen. Case XXXVI was burned in the treatment of eczema; Case XXXVII was burned in the treatment of psoriasis and Case XXXVIII in the postoperative treatment of the soles of the feet after excision of bilateral fibrosarcomata. The burned areas were excised in each instance, but the treatment varied in each. In Case XXXVI small deep grafts were applied after granulations had formed. Thick Ollier-Thiersch grafts were transplanted in Case XXXVII and pedunculated flaps from the opposite legs were used to secure stable healing in Case XXXVIII. Good functional results were obtained in all these cases.

REMARKS

In many instances keratotic patches which develop in tissue previously burned by roentgen rays are not benefited by treatment with radium. In fact, some of these lesions seem to thrive under such treat-

ment and become much worse. As I have said previously, I am very skeptical as to the value of treating deep burns which are caused by roentgen rays with radium and vice versa, or with more roentgen rays, or with more radium, as the case may be. In fact, I do not believe that rays of any sort should be used in treating deep burns. My opinion is based on the results seen in a large number of patients who have come to me for treatment after roentgen-ray burns have been treated with radium, or more roentgen rays, and radium burns have been treated with roentgen rays, or more radium. In addition ultraviolet rays, infrared rays and various other rays have also frequently been tried out on some of these unfortunates.

In these cases only one rational method of treatment has so far been developed and that is as complete excision as possible, with tissue shifting to fill the defect thus made. Possibly the same result could be obtained by some method causing a sloughing out of the entire area, with subsequent grafting of the defect, but such a method could not be controlled as well as can definite excision.

We usually remove the glands, draining the area, when the radiation burn shows malignant degeneration, but there is some question as to the advisability of removing this gland barrier unless there is evident involvement, as the removal of a barrier which is uninvolved will prevent protection for subsequent malignant degenerations which may occur at any time in any area with deep radiation changes. In many instances the tissues around a malignant degeneration due to radiation burns are so converted into impervious scar that there is little chance of the growth spreading by the usual channels and this is a most fortunate happening. So before removing uninvolved glands the matter should be carefully considered.

A study of the cases illustrated in this report may convince the reader that the use of roentgen rays and radium is not entirely without the possibility of danger both to the patient and to the operator. The cases shown are only a few of those which have been under my care for these burns. When one realizes that only a very small percentage of the patients so afflicted could come to me for treatment, then the magnitude of the danger becomes apparent. I should like to reiterate a warning given elsewhere, that every effort should be made during both superficial and deep treatments with roentgen rays and radium to regulate the dosage properly and to protect the surrounding and underlying normal tissues. Furthermore, I feel very strongly that these powerful agents should be used for therapeutic purposes only by experts, and then with the utmost caution.

Vol. XXIX, No. 1

ROENTGEN THERAPY OF RHEUMATIC HEART DISEASE

A REVIEW OF SIX YEARS' EXPERIENCE*

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INTRODUCTION

IN May, 1925, a girl aged thirteen had been in bed on a ward in the Presbyterian Hospital for nine months, suffering from rheumatic fever with cardiac involvement. During this period, there was continued elevation of temperature, chest pain and leucocytosis, although the joint manifestations were negligible. The heart was large and the signs were those of mitral stenosis and insufficiency. Anti-rheumatic drugs were administered repeatedly in large doses, and several small transfusions were given. All discoverable foci of infection were eradicated. Dyspnea, edema and the signs of active rheumatism persisted and appeared to be due chiefly to carditis.

Because of the successful use of roentgen irradiation in the treatment of certain low-grade infections, deep roentgen therapy was given over the cardiac area, the quantity of rays being calculated to yield about 10 per cent of the skin erythema dose throughout the region of the heart. Five days after the first treatment, the temperature fell to normal, with parallel decrease in heart rate. With but few minor setbacks, improvement continued. During the next eleven months, she received 13 roentgen treatments. Following the institution of therapy, the electrocardiogram showed changes in form for eighteen months and then became fixed. During the past five and a half years, this girl has gone to school regularly and there has been no recrudescence of rheumatism. She has developed normally and gained in weight. An aortic diastolic murmur, which was present at times during the acute phases of the illness, has disappeared. The relationship between irradiation and the onset of improvement seemed definite; and the patient's progress since leaving the hospital has been much more satisfactory than might have been anticipated in this type of case.

Encouraged by almost immediate improvement in this case, we undertook to treat a series of patients suffering from various forms of rheumatic fever with signs of active cardiac involvement. Two reports of this work have already been made and a review of the pertinent literature has been given.[1,2] It has seemed to us of interest to review briefly our experience to date.

The variable course of rheumatic fever is well known. The anti-rheumatic drugs are generally conceded to be of only symptomatic value. The use of specific sera and of vaccines has yielded results which have been viewed favorably by some observers, but their employment has not met with universal approval. Eradication of foci of infection, prolonged rest and measures designed to improve the general health of the patient, are probably the best aids in promoting recovery from an acute attack. The criteria for determining the therapeutic value of any measure in a disease in which the causative agent is unknown and the mechanism of tissue involvement is obscure, must of necessity be vague. Furthermore, in an analysis of 252 cases of rheumatic fever from this hospital, Mackie[3] found that only 57 per cent of the first recurrences occurred within four years of the primary attack. In the appraisal of our own results, we are only too well aware of the various factors which may modify their interpretation. Certain objective observations are possible; but, in the main, estimation of the effects must be made on the basis of clinical impressions. It is with this point of view clearly in mind that our results are herewith presented. For convenience, the technique employed is again noted.

* From the Department of Medicine, College of Physicians and Surgeons of Columbia University, and the Presbyterian Hospital, New York City. Read before the Midwinter Roentgenological Conference of Eastern Roentgen Ray Societies, New York City, Jan. 29, 1932.

TECHNIQUE OF IRRADIATION

With the aid of a depth-dose chart and a cross-section diagram of the chest at the level of the fourth chondrosternal junction, there was calculated a quantity of rays yielding about 10 per cent of the skin erythema dose throughout the region of the heart when applied over a front and a back field. Each field was centered about 5 cm. to the left of the midline. The machine setting was 200 kv. (peak), 50 cm. target skin distance and 0.5 mm. copper plus 1.0 mm. aluminum filter. If nausea and vomiting occurred the dose was diminished to 8 per cent of the calculated erythema dose. The sittings were repeated at two week intervals until 4 exposures had been given. At least a month, sometimes two or three, was allowed to elapse before beginning another series. From 2 to 25 irradiations were given to individual patients; a majority received 4 or more.

RESULTS

Thirty-two cases have been followed with sufficient care to warrant their inclusion in this series. A summary is given in Table 1. Eighteen patients have been followed for more than two years, and 7 for more than five years. In 17 cases, improvement followed roentgen therapy. All of them have been entirely free from detectable recurrence of rheumatic infection, and have been able to carry on with their activities to an extent consistent with the amount of mechanical cardiac damage. In 7 instances, the effects of therapy were of doubtful value, either on account of the short duration of the follow-up period or because only one course of roentgen therapy was administered. All of these 7 patients have fared well. Two cases, followed for only two and four months respectively, apparently were not at all benefited.

TABLE I

Summary	
32 Cases; 281 Roentgen Irradiations	
Duration of Follow-Up Since First Irradiation	
5 to 6 years	7 cases
4 to 5 years	3 cases
3 to 4 years	4 cases
2 to 3 years	4 cases
1 to 2 years	6 cases
Less than 1 year	8 cases
Clinical Condition at End of Follow-Up Period	
Improved	17 cases
Improved (relationship to therapy doubtful)	6 cases
Unimproved	2 cases
Died	7 cases
Electrocardiographic Changes	
Present	19 cases
Absent	11 cases
Not recorded	2 cases

Seven patients are dead. The period from the first roentgen treatment to death ranged from six months to five and a half years. Two died of non-hemolytic streptococcus endocarditis and 5 of cardiac insufficiency, associated with recrudescence of active carditis. Examination of the heart of one of these latter patients, eleven months after the last of 9 irradiations, showed numerous scars in the heart muscle and an occasional Aschoff body. There were no changes which could be ascribed to the effects of roentgen rays.

One of the most striking features has been the relief of paroxysmal heart pain in 5 instances. In 3 of these cases, there was involvement of the mitral valve alone; in 2 cases the aortic orifice was also affected. In 2 patients, the pain was relieved temporarily. In another case, no relief whatever was afforded. The history of a girl aged eighteen has already been briefly recorded in an earlier publication.[2] The heart was greatly hypertrophied and she was entirely incapacitated because of pain and cardiac insufficiency. The signs were those of mitral stenosis and insufficiency, but no aortic valve lesion was present nor has any developed. During a period of seventeen months, 25 irradiations to the heart were given. The form of the electrocardiogram changed frequently during the first sixteen months, then became constant and has remained so. The attacks of precordial pain entirely disappeared, the functional capacity of the heart improved and two years after the first irradiation, she began to work

in a secretarial position. It is now almost six years since treatment was undertaken. She has continued at her job without interruption, commutes daily from New Jersey to New York and is socially active several nights each week. In this case, complete relief from pain was afforded and a smoldering carditis was apparently rendered inactive.

No harmful effects of roentgen therapy were observed. In 16 cases, unpleasant irradiation reactions occurred—nausea or vomiting in 9, increased chest pain in 4, headache in 2, and temporary exacerbation of fever in one.

In the course of rheumatic fever, variations in the form of the electrocardiogram are frequently observed, due to alterations in the myocardium induced by rheumatic lesions. In this study, several control records were always made and the possible effect of digitalis was excluded. Electrocardiographic changes following roentgen treatments were recorded in 19 cases and were absent in 11 cases; in 2 cases, there was an insufficient number of graphs for adequate comparison. The nature of these form changes has been discussed in detail in previous papers.[1,2] The alterations in the form of the curves occurred in direct relationship to roentgen therapy, and in several instances the same type of change recurred after repeated courses of treatment. It is our belief that the changes noted in these records were due to the effects of the rays on the lesions in the heart muscle. That such lesions vary in their susceptibility to irradiation at different stages of their evolution seems altogether likely.

COMMENT

In the group of 32 patients comprising this series are included cases of varying degrees of severity, with ages ranging from six to forty-two years. Some were patients in their first attack; others had suffered from repeated rheumatic manifestations since early childhood. In certain instances, the infection appeared to be mainly cardiac; in others, high fever, crops of subcutaneous nodules, recurring arthritis and increasing signs of cardiac involvement indicated that the disease was disseminated throughout the body and was progressive. It was to be expected, therefore, that the results of roentgen therapy might be variable. The milder cases in the first attack naturally appeared to respond most favorably. It is possible that in these individuals the liability to further cardiac damage may be minimized, although the duration of the radiation effect is unknown. Patients who received several courses of treatment fared best, and it is probable that at least one course of 4 exposures is essential to produce any significant result. It is our distinct impression that the best results have occurred in patients with paroxysms of cardiac pain, and in those in whom a smoldering carditis of low grade has proved unresponsive to the usual forms of therapy.

It would be hazardous, in the present state of knowledge, to attempt to explain the possible mode of action on the rheumatic heart of roentgen irradiation. Its use has been reported as beneficial in various types of infection, as well as in certain instances of painful affections of the heart, commonly termed "angina pectoris." It is conceivable that irradiation may modify the type of tissue reaction, either through a local or a general effect. We have previously suggested the possibility that roentgen rays might induce desensitization of the cardiac tissues, which may have become allergic as the result of rheumatic infection.[2] But hypotheses unsupported by facts are of limited value.

SUMMARY

1. Thirty-two patients with rheumatic heart disease of varying degrees of severity received 281 roentgen irradiations over the cardiac area during the past five and three-quarters years.

2. In 17 instances, improvement has been observed, in some cases more marked than might have been anticipated. In 6 cases, therapy was considered to be of doubtful value, and 2 cases were definitely not improved. Seven patients have died—

2 of subacute bacterial endocarditis, and 5 of cardiac insufficiency.

3. Five patients with paroxysms of severe heart pain have been completely relieved of this symptom. Temporary relief was afforded in 2 other cases, and in one instance no beneficial effect was observed.

4. In a number of cases, following roentgen therapy, a low-grade, smoldering carditis apparently has become inactive. In such patients there have been no signs of recrudescence of active rheumatism during the period of observation, which in 7 instances has been over five years.

5. Changes in the form of the electrocardiogram have been noted in 19 cases. These changes were regarded as due to the effects of irradiation on the myocardium, with modification of the rheumatic lesions.

6. Irradiation reactions were observed in 16 patients. There was no evidence of injury to the heart nor was the course of the disease unfavorably influenced.

7. Our earlier impressions concerning the value of irradiation of the heart in rheumatic carditis have been confirmed after a six year period of observation. Patients in the first attack of rheumatic fever, with slight cardiac involvement, offer the best chance for successful therapy, and in them the danger of subsequent cardiac damage may be minimized. In cases with a low-grade infection and predominantly cardiac involvement, activity of the lesions often appears to subside following roentgen treatment. Roentgen therapy may afford great relief to certain patients with rheumatic heart disease in whom paroxysmal cardiac pain is the chief form of discomfort.

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ROENTGEN TREATMENT OF LYMPHOBLASTOMA (HODGKIN'S DISEASE)*

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NINETY-NINE years ago Hodgkin[4] described a group of cases all having a more or less generalized lymphadenopathy. Since then his name has been associated with an obscure condition which is now called by many names, such as lymphadenoma, lymphoblastoma, pseudoleucemia and lymphogranulomatosis.

After almost a century the etiology of this disease remains in doubt. Twort,[7] after six years of painstaking investigation, failed to confirm the work of Fraenkel and Much,[3] Kofoid and his associates,[5] Coyon and Brun,[2] and Bunting and Yates.[1] He rather cautiously suggests that the disease is a new growth instead of "what is generally accepted as a granuloma."

L'Esperance's[6] investigation on avian tuberculosis is one of the more recent contributions to the bacterial side of the problem and whether conclusive or not is at least an interesting possibility.

And so, from an etiological standpoint, there will be someone to agree, whatever the assumption. If we still favor the possibility of infection we readily admit that "there is much to be said on both sides," and feel that at present we are groping in the dark, with the etiology undetermined and the prognosis unfavorable. Under these conditions we are bound to think of therapy without any undue optimism.

The roentgen ray has long been used therapeutically and we believe it to be helpful usually, and, with proper supervision, never harmful. Any powerful drug in excessive doses is dangerous, but an occasional accident due to stupidity or ignorance does not mean we should give up morphine, digitalis or chloral. And surely it is not fair to be hypercritical of radiotherapy when results are not always satisfactory, especially when a disease as serious as Hodgkin's is being treated.

In early cases where the process is well localized large doses at infrequent intervals

HODGKIN'S DISEASE

Total Number of Cases—42 (biopsy positive)
Male, 28; Female, 14

Cases Followed to Death—32
Average age—29 years
Average duration of illness—2 yr. 8 mo.
Average number of treatments—28

Cases Lost to Follow-Up—5
Average age—28 years
Average duration of illness—2 years
Average number of treatments—10

Cases Living—5
Average age—35 years
Average duration of illness—5 yr. 10 mo.
Average number of treatments—39

Doubtful Cases—4
Average age—31 years
One lost after 5 yr. 2 mo.
One died after 5 yr. 11 mo.
Two living after 11 yr 3 mo. and 7 yr. (respectively)
Average number of treatments—49

Of 42 cases:

1 (2.4 %) occurred in 1st decade	Average duration 3 yr. 2 mo.
5 (11.9 %) occurred in 2nd decade	Average duration 3 yr. 9 mo.
11 (26.1 %) occurred in 3rd decade	Average duration 4 yr. 10 mo.
16 (38.05%) occurred in 4th decade	Average duration 1 yr. 8 mo.
5 (11.9 %) occurred in 5th decade	Average duration 2 yr. 8 mo.
3 (7.2 %) occurred in 6th decade	Average duration 2 yr. 4 mo.
1 (2.4 %) occurred in 7th decade	Average duration 7 mo.

* From the Departments of Medicine and Roentgenology, Presbyterian Hospital and Columbia University, New York City. Read at the Thirty-second Annual Meeting, American Roentgen Ray Society, Atlantic City, N.J., Sept. 22–25, 1931.

	Number	Name	Sex	Age	Duration	Treatments
1.	39140	M.L.	F.	23	5 yr. 8 mo.	149
2.	42181	F.McQ.	F.	22	6 yr. 3 mo.	95
3.	42185	A.A.	M.	37	3 yr. 3 mo.	75
4.	42346	P.	M.	15	5 yr. 6 mo.	94
5.	42787	L.A.	M.	45	11 mo.	13
6.	44627	M.McM.	F.	29	5 mo.	11
7.	46710	F.H.	F.	25	4 yr. 5 mo.	139
8.	47810	E.H.	M.	13	4 yr. 10 mo.	41
9.	48420	S.P.	F.	40	6 mo.	4
10.	49499	F.K.	M.	50	2 yr.	41
11.	51555	A.L.	M.	30	2 yr. 3 mo.	11
12.	53243	M.deB.	M.	39	7 mo.	18
13.	54941	J.O'C.	M.	58	3 yr.	7
14.	56742	J.McN.	M.	15	1 yr. 11 mo.	22
15.	56892	S.S.	F.	45	3 yr.	9
16.	56969	P.O.	M.	15	11 mo.	4
17.	58073	M.L.	M.	37	8 mo.	12
18.	58074	J.S.	M.	39	1 yr. 1 mo.	18
19.	61049	E.F.	F.	21	2 yr. 8 mo.	14
20.	61886	J.W.	M.	66	7 mo.	3
21.	62397	A.D.	F.	46	6 yr. 4 mo.	3
22.	63276	F.S.	M.	37	2 yr. 5 mo.	33
23.	64713	L.G.	M.	32	2 yr. 1 mo.	88
24.	66170	O.H.	M.	21	5 yr. 3 mo.	29
25.	67837	C.J.	F.	24	1 yr. 8 mo.	8
26.	72124	R.R.	F.	29	4 yr. 10 mo.	8
27.	72702	G.M.	M.	36	10 mo.	9
28.	78860	S.	M.	22	3 mo.	8
29.	79886	H.L.	M.	30	2 yr. 4 mo.	12
30.	82073	M.S.	F.	37	9 mo.	4
31.	118510	J.K.	M.	14	5 yr. 8 mo.	11
32.	P.P.	S.L.	M.	44	2 yr. 6 mo.	15
			Lost After			
33.	65597	R.V.	M.	33	3 mo.	3
34.	76483	C.F.	M.	38	2 yr. 2 mo.	21
35.	107104	C.H.	F.	31	1 yr. 3 mo.	10
36.	129953	M.C.	F.	30	3 yr. 2 mo.	Radium
37.	137110	T.C.	M.	8	3 yr. 2 mo.	16
			Living			
38.	55025	M.T.	F.	23	12 yr. 5 mo.	40
39.	68607	H.H.	F.	24	10 yr. 8 mo.	35
40.	71767	V.S.	F.	35	3 yr. 3 mo.	97
41.	192103	V.M.	M.	55	1 yr. 11 mo.	4
42.	264207	F.W.	M.	31	1 yr. 1 mo.	18
			Doubtful Cases			
43.	65646	J.E.	M.	13	Lost after 5 yr. 2 mo.	34
44.	81609	E.D.	F.	43	Died 5 yr. 11 mo.	43
45.	241985	G.G.	M.	35	Living 11 yr. 3 mo.	82
46.	257823	M.A.	F.	33	Living 7 yr.	37

may be indicated, but with the well-developed, slowly progressing and resistant type, especially of the deeper tissues, small doses at frequent intervals may produce most gratifying results. As a rule, we prefer not to consider it a new growth, at least from the standpoint of radiotherapy.

The enthusiast who is easily discouraged and wants quick results will do well to leave these patients to one who is willing to "make haste slowly." The plodder may be far more successful here than his brilliant but impatient colleague.

The following observations were made on 42 cases (proved by biopsy), all of which were studied in the Presbyterian Hospital and Vanderbilt Clinic. In addition, we have recorded 4 cases that we list as "doubtful." Of these one refused to permit a biopsy and 3 others were from a microscopic standpoint so difficult to diagnose that the pathologists either did not agree or refused to commit themselves.

A long and detailed discussion of the course and prognosis of this disease has no place in the present paper. It will be enough to mention a few of the outstanding signs and symptoms of an advanced case of Hodgkin's disease.

The extensive and rapid increase in the size of the lymph nodes is too well known to merit more than casual mention. The anemia is also usually obvious. On the other hand, *loss of weight*, *fever* and *itching*, especially when they appear together, nearly always indicate a bad prognosis.

TECHNIQUE OF RADIOTHERAPY

The superficial nodes usually receive $\frac{1}{2}$ to $\frac{2}{3}$ the erythema dose of medium voltage roentgen rays, with 3 mm. aluminum filter, repeated in two weeks.

For mediastinal or abdominal nodes we use 200 kv. with 0.5 mm. copper plus 1.0 aluminum filter, and 50 cm. anode-skin distance. The quantity is usually $\frac{1}{8}$ of the erythema dose at one sitting, repeated at intervals of two to four days at first. Later the intervals are likely to be longer. However, in certain cases which appeared to be in the refractory stage, very small doses (1/12 erythema dose or less) have been used with one to two day intervals with interesting results to be discussed below. It is important to avoid gastric upsets by careful adjustments of dosage and intervals to the requirements of the individual patient.

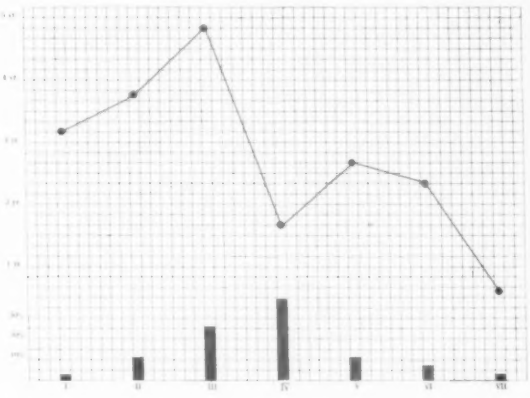

Fig. 1. Graph illustrating age, distribution and course of disease. Columns indicate percentage of patients in each decade (as indicated by Roman numerals). Line illustrates average number of years patients lived in each group after diagnosis was made.

We prefer not to treat patients who are running a fever but obviously in the later stages there is sometimes no choice.

To draw too many conclusions from a single case, or write a paper about a single guinea pig, is not, as a rule, considered good form. On the other hand, to talk at length about many cases and present a confusing mass of details may prove far more tedious than instructive. Our claim is that certain cases of Hodgkin's disease may be helped by the careful, intelligent use of radiotherapy, and to substantiate this contention we submit the following 3 cases:

Case 38 (Presbyterian Hospital No. 55025). Mrs. M.T.K.

In 1922, the patient (aged twenty-three) came to the hospital with a four-year history of two lumps, one of which had appeared in the left axilla and one just above the left collar bone. Both had been removed surgically and she had been told the diagnosis was Hodgkin's disease (which, fortunately, meant nothing to her).

The family and past history were not significant.

The patient was an only child, a college graduate, and when first seen (1922) was engaged in secretarial work. Her health was good. She was athletic, had an excellent appetite, and slept well, was not apprehensive and perfectly willing to follow instructions.

A physician sent her to the hospital because for two months there had been another mass below the left collar bone. This "lump" had been gradually increasing in size until it was as large as an olive. It had never been red, hot or tender. There was no history of loss of weight or of fever.

On examination the patient was a normal, healthy young woman, weighing 135 pounds.

Only three lymph nodes were found, one small and "shot-like" on left side of neck in posterior triangle; one 3 cm. in longest diameter just below middle third of left clavicle, and one about 1 × 1.5 cm. in left axilla.

Scars were present in left supraclavicular fossa and in left axilla.

Roentgen examination of the chest revealed no evidence of mediastinal nodes.

The von Pirquet skin test was positive. Blood Wassermann negative.

Blood count: Hemoglobin, 86 per cent; white blood cells, 7,200; blood platelets, 210,000; neutrophiles, 69 per cent; eosinophiles, 0.6 per cent; basophiles, 0.3 per cent; lymphocytes, 26.4 per cent; monocytes, 3.7 per cent.

The node from the left axilla was removed and Dr. W. C. Von Glahn concluded his report thus: "The histological picture is that of an early Hodgkin's disease. It is of considerable interest that the glandular enlargement has existed for about four years."

The patient was given radiotherapy and seen every month or so. She varied a little in weight but there was usually some explanation for this, such as fatigue, poor food, etc.

The lymph nodes near the left clavicle and in the left axilla were usually palpable but always tended to decrease in size after radiotherapy.

In all, she was given 40 suberythema doses at Presbyterian Hospital. In 1927 (four years ago) she was married and moved to California. She became pregnant but did not come to term. In part this may have been due to the great shock she experienced when a physician, with more honesty than tact, told her too much about Hodgkin's disease. This storm was weathered, however, and when last seen (about one year ago) she appeared perfectly well. No nodes were palpable nor was the liver or spleen palpable. She weighed 158 lb., or 23 lb. more than when first seen (some eight years before).

Comment. An example of a patient with Hodgkin's disease, who is still living and well about thirteen years after the first symptoms (1918).

CASE 46 (Presbyterian Hospital No. 257823). Mrs A. came to the clinic first in 1927. Her knowledge of English was limited, and her history of her case left much to be desired.

Her chief complaint was weakness and pain in the left side.

For seven years lumps had been noticed in her neck, under both arms and in the groin. Itching had also been an annoying symptom for over three years.

In 1924 (three years before she came to Presbyterian Hospital) she was treated with radiotherapy, and the provisional diagnosis of Hodgkin's disease was made.

The patient was a pale, undernourished Italian woman (weight 120 lb.), aged about thirty. Temperature 100°.

All the superficial lymph nodes were enlarged, and a large, tender spleen was easily felt.

Blood Wassermann, urine and test meal showed nothing pathological.

Blood count: Hemoglobin, 57 per cent; red blood cells, 4,000,000; white blood cells, 11,000; neutrophiles, 79 per cent; lymphocytes, 20 per cent; eosinophiles, 1 per cent.

The patient was seen by several of us and all agreed that Hodgkin's disease was the probable diagnosis. This was borne out by a roentgen examination of the chest. However, we failed to obtain her consent to a biopsy.

Radiotherapy was begun. The spleen received the most attention but the superficial nodes and mediastinum were also irradiated.

The dosage was as follows: the superficial lymph nodes received from $\frac{1}{3}$–$\frac{1}{2}$ skin erythema dose, medium voltage; the mediastinum $\frac{1}{4}$ S.E.D. and the spleen from $\frac{1}{8}$–$\frac{1}{5}$ S.E.D.

The exposures were given twice a week for a while, then once a week, and, finally, every two weeks. Owing to the usual difficulties about keeping appointments there was, of course, some variation, but in five months she was treated 21 times.

During this course of treatments she was followed in the clinic, and in addition to the radiotherapy, she was treated with ultraviolet rays. She gained a pound or two, although the itching continued, and the nodes and spleen decreased a little. The improvement was not remarkable but definite.

She was seen on February 9, 1928, then disappeared and all attempts to locate her failed.

About eighteen months later, June 3, 1930, she reappeared complaining of weakness, pain in left side and intolerable itching. She had been failing steadily for six months and was perfectly willing to enter the hospital.

The patient presented the picture of one acutely ill. Temperature 101.4°F., pulse 132; respiration 32+; weight 106 lb. The superficial lymph nodes again were enlarged, and the spleen, which again was tender, extended well below the umbilicus. Hemoglobin 45 per cent; red blood count, 2,500,000.

She was admitted to the ward and given two transfusions, which brought the hemoglobin up to 55 per cent. Her temperature continued to run up to 102° or 103°F. in the morning. The prognosis seemed utterly hopeless and radiotherapy hardly worth while. However, in two weeks she was treated 5 times over the spleen with deep roentgen therapy. The dosage was reduced to 1/8–1/10 S.E.D. The afternoon rise in temperature continued but was not so marked and there was some improvement.

FIG. 2. Case 40. June 27, 1928. Roentgenogram of chest before diagnosis was made.

FIG. 3. Case 40. July 15, 1929. Roentgenogram of chest at time of diagnosis, before roentgen therapy was begun.

She became homesick and, because the outlook was so dubious, was allowed to leave the ward on June 26, 1930.

During July and August, 1930, the roentgen therapy was continued in the dispensary. Five exposures were given over the superficial nodes and the spleen.

Her change for the better continued and during the autumn she was given a final course of 8 exposures (7 over the spleen and one over the mediastinum).

Early in December, 1930, she left town, greatly improved. She weighed 122½ lb., which was a gain of 16½ lb. in five months. Although still anemic, the general clinical picture had changed greatly.

CASE 40 (Presbyterian Hospital No. 71767). On June 4, 1928, Mrs. S. came to the hospital for observation. For fifteen months she had complained of weakness, fever and night sweats.

One sister seems to have died of tuberculosis; otherwise the family history was not significant.

The patient had been married about four years but had never been pregnant. After several attacks of abdominal pain her appendix was removed (a year before she came to us) and

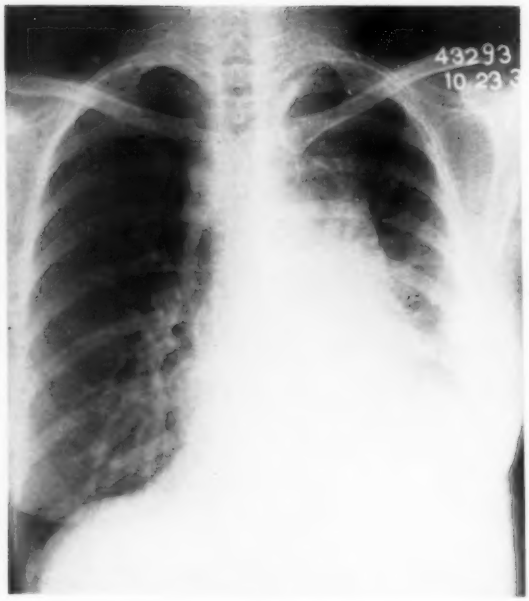

Fig. 4. Case 40. October 23, 1929. Showing changes after first series of roentgen treatments.

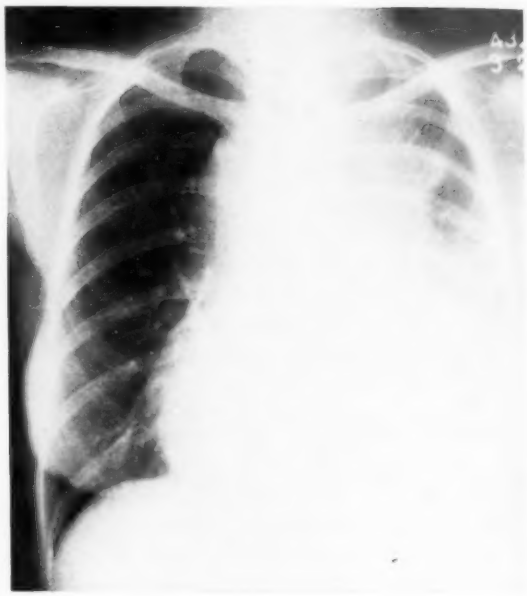

Fig. 5. Case 40. March 27, 1930. Although still under treatment patient was growing worse clinically.

since then her gallbladder had been under suspicion.

In addition to weakness, fever, night sweats and some loss of weight, she had pains in the left shoulder and a "dry cough." In this brief résumé of a complicated history, it is obvious why tuberculosis seemed the most probable diagnosis.

Examination revealed a woman of thirty-five, fairly well nourished and developed; pale, but not acutely ill. She weighed 110 lb., which was 6 lb. below normal. Superficial lymph nodes were not enlarged. The important physical findings were located in the left chest, where there appeared to be definite signs of fluid. The abdomen was soft. No masses nor tender areas were discovered, nor was the liver or spleen felt.

The hemoglobin was 68 per cent; red blood cells, 3,400,000; white blood cells, 12,000; neutrophiles, 89 per cent; lymphocytes, 7 per cent; monocytes, 4 per cent.

Roentgen examination of the chest showed large mediastinal lymph nodes and encapsulated fluid (Fig. 2).

This was found (not without difficulty) and 650 c.c. of slightly turbid fluid was removed. Rather to the surprise of everyone, microscopic examination, cultures and guinea pig inoculation all were negative for tuberculosis.

After a stay in the hospital of slightly over three weeks, she returned to her home, had less fever, gained a little and seemed better. Her chest was aspirated twice during the next six months, but, on the whole, she did very well until the winter (1929–1930) when she had an acute gastrointestinal upset, accompanied by fever, prostration and loss of weight.

On July 15, 1929, she returned to the hospital, complaining of increasing shortness of breath and weakness.

She presented a pathetic picture as she lay on her left side, and because of dyspnea found it difficult to talk. Any exertion caused acute distress.

A few superficial lymph nodes were palpable but none were larger than 1 or 2 cm. in diameter. The spleen extended 3 cm. below the costal margin.

The signs over the left chest again indicated a large amount of fluid, but three attempts with an exploring needle proved futile (Fig. 3).

While we were trying to make her somewhat comfortable, word came from the Rhode Island Hospital that a diagnosis of Hodgkin's disease had been made from sections of a lymph node. Later our pathologists had an opportunity to examine the sections and all agreed with the diagnosis.

At this time the patient presented a picture of great discomfort. Besides the dyspnea, which was worse than on her last admission, she was tortured with a generalized itching which resisted all therapy. A constant "tickling" cough made sleep practically impossible.

Because of the anemia, she was given two transfusions. Opiates and sedatives were necessary, especially at night.

We decided to try roentgen therapy over the mediastinum, but she was nauseated by $\frac{1}{8}$ S.E.D. Inasmuch as some therapy was essential, we reduced the dosage to 1/12 S.E.D., which caused no discomfort whatever, and continued with an exposure every two days. She began to improve almost immediately, and left the hospital, much improved, twenty-four days after admission, having had 8 treatments.

The summer of 1929 was spent chiefly at her home but we were able to treat her 12 times before October 23, 1929. The films at this time (Fig. 4) show the favorable result of roentgen therapy.

It was inconvenient for her to come in regularly and so we did not see her during the winter of 1929–1930 until March. Her progress, however, had not been satisfactory and a photograph taken on March 27, 1930 (Fig. 5), showed that she had been losing ground.

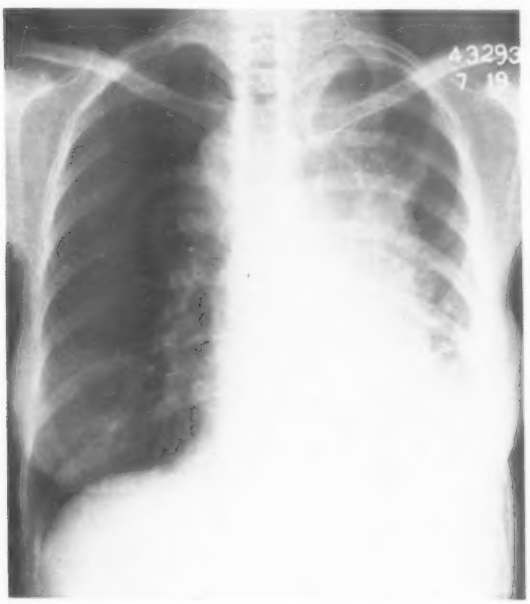

Fig. 6. Case 40. July 19, 1930. Roentgenogram taken four months after Figure 5. Note change in shadows. Daily small doses had been given for about five weeks. Clinical improvement was marked.

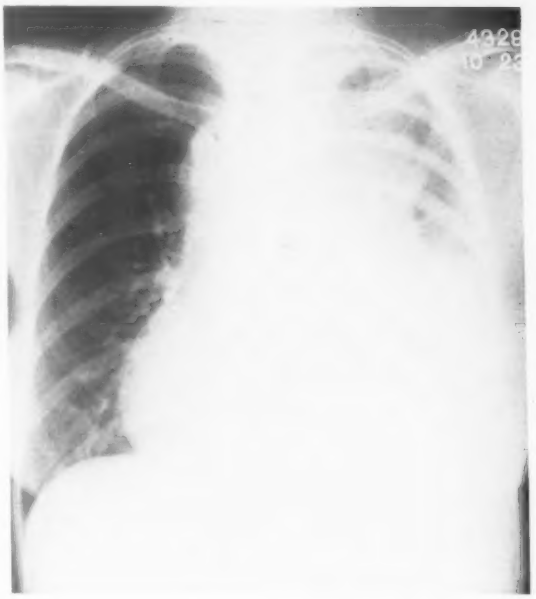

Fig. 7. Case 40. October 23, 1930. Roentgenogram taken fifteen months after Figure 2. Patient had just received second series of small doses given every day or every other day.

Again she went home and between April 30 and June 14, she was treated at the Rhode Island Hospital, where she was given 6 exposures over the chest and 2 over the spleen.

The improvement of a year before was rapidly vanishing and, on June 22, 1930, she returned with the same picture of dyspnea, prostration and itching. Morphine was necessary to make life bearable. She now weighed only 94 lb., or 16 lb. less than on first admission.

At this time we decided to try again minimum daily doses of roentgen therapy over the chest, and she was given 1/12 S.E.D. every day.

Again she improved, not rapidly but steadily, and was able to leave the hospital in less than a month.

From June 23 to July 19, 1930 (that is, during the admission just referred to) she received a treatment *every day* but Sunday (Fig. 6).

Then she was treated 3 times a week (September 15 to October 7).

The dosage was again reduced to 1/20 S.E.D. and treatments were given 6 times a week until December 10, 1930, when she was allowed a three weeks' rest (Fig. 7).

Comment. Here, then, was an advanced case of Hodgkin's disease involving the mediastinum.

The patient came to the hospital on two occasions about a year apart and although she seemed beyond the reach of therapy, on both occasions was evidently helped by roentgen irradiation.

A comparison of Figures 5 and 6 (which were taken approximately four months apart) will indicate the improvement, which was just as marked clinically. During the period the patient received 8 treatments at the Rhode Island Hospital, and 21 at Presbyterian, which were given almost every day (i.e., 21 treatments between June 23 and July 19), the improvement was all the more gratifying, as it came after a recrudescence of the disease.

In eighteen months she received in all 105 treatments and was enabled to carry on and live a normal if somewhat limited life. The improvement perhaps is only temporary, but the change has certainly been dramatic if not permanent.

DISCUSSION OF CASES

It has been said that all cases of Hodgkin's disease fall into one of two groups. In one group all seem to do well with or without treatment; the others all do badly and roentgen therapy is always useless and sometimes injurious. Bearing this in mind, let us consider the 3 patients just discussed.

The first, Case 38, on three different occasions, by two different groups of pathologists, had the diagnosis of Hodgkin's disease made from biopsy, so it is reasonable to assume that the diagnosis was correct. Thirteen years after the enlarged nodes were discovered, she is well, active and up to her best weight. The critically inclined may imply that we did her no good. But the fact remains that she was treated 40 times by us and perhaps 20 times by others. We think we helped her. We certainly did her no harm.

It is unfortunate that Case 46 would not permit a biopsy. However, the clinical picture is so similar to that of the following case that we seem justified in considering this a case of Hodgkin's disease. There is no question about her improvement, but it does not show roentgenographically, as her treatment was chiefly over the spleen.

Case 40 is an example of what can be done with roentgen therapy. The roentgenograms tell the story.

To say that these patients are cured is to claim too much but there is no gainsaying the improvement after the treatment, and that when the last two cases seemed to be in the terminal stages of the disease.

CONCLUSIONS

Roentgen therapy is indicated in Hodgkin's disease and, as a rule, the smaller dosage at frequent intervals produces the best results.

While willing to admit that Hodgkin's disease is incurable, we feel justified in maintaining that some patients do surprisingly well when treated with roentgen rays —so well that it is quite possible that death may be due to other causes. We do not expect to cure, but hope to make life not only longer but happier.*

* For discussion see page 100.

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Vol. XXIX, No. 1

MYELOGENOUS LEUCEMIA*

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REPORTING results obtained by any form of treatment in chronic diseases is usually speculative; myelogenous leucemia is no exception. To begin with, it is impossible to estimate how long these patients would live without any form of treatment. After treating many leucemia patients during the past fifteen years I am not convinced that we prolong their lives; possibly in some cases life is prolonged. I am sure, however, that we do make them more comfortable and also more useful. Often patients confined to bed, weak and with loss of ambition can be helped by roentgen therapy and returned to work.

There is always the possibility of the therapist becoming over-enthusiastic about his results. I know we have felt on several occasions we were doing wonders with our treatment. On careful examination of our records we found the usual footnote—"Expired."

I do not wish to be too pessimistic, for I am convinced that we do help a certain group of these patients. How can we give a prognosis? Can we tell or differentiate the favorable from the unfavorable case? The blood work done in recent years by Piney, Isaacs and others does, we believe, give valuable data. We have read the work of Isaacs with considerable interest and feel that his classification is satisfactory and applicable. Last Spring we had 5 myelogenous leucemia patients in the hospital on one service. The method of Isaacs was followed carefully with reference to the blood counting. The saliva counts were also carefully made, but we failed to obtain much information from this source. In some of the patients who reacted favorably there was no increase in the saliva count—most patients showed no change in the saliva count, regardless of the response to treatment.

It has been our experience that in patients having a high myeloblastic count the prognosis is unfavorable. The patients we have treated who have lived over five years showed a very small percentage of myeloblasts. We have usually observed a marked increase in the myeloblasts just prior to death; a marked increase in the myeloblasts we consider a bad sign and death usually follows promptly.

That roentgen irradiation does cause a decrease in the circulating leucocytes and an improvement in the cellular composition of the blood is an accepted fact.

Contrary to the older writers, such as Virchow, leucemia is not now considered as a disease of the blood, but as a disease of the blood-forming tissues. There may be only slight quantitative changes in the circulating leucocytes with marked qualitative changes; the commonly called pseudoleucemia or aleucemic leucemia. During the course of myelogenous leucemia it is not uncommon to have a marked decrease in the number of leucocytes. The count may become very low, but there will still be many pathological cells. These changes are important and should be carefully watched for during roentgen therapy—aplastic changes may be due to severe damage to the bone marrow.

The spleen in most of our cases has been enlarged; in some instances moderately so, while in others practically the entire abdomen was filled by the spleen. We have seen many patients with gastrointestinal distress due to the large spleen. Roentgenoscopic examination following the barium meal usually shows a greatly distorted gastrointestinal tract with a marked displacement of the stomach. Most patients complain of pain in the left upper quadrant which may be due to the weight of the large spleen. On palpation the spleen is tender. It is our opinion that the consistency of the spleen is of great importance. We have al-

* Read at the Thirty-second Annual Meeting, American Roentgen Ray Soceity, Atlantic City, N.J., Sept. 22–25, 1931.

ways felt that our results were better when the spleen was soft than when hard on palpation. The large, soft spleen is preferred to the hard and only moderately enlarged spleen. We have tried in our treatment to avoid irritating the spleen. In some cases only a small portion of the spleen has been irradiated, but never the entire spleen. The cross firing of the spleen will reduce its size but it becomes hard.

The function of the spleen in leucosis is to form leucocytes and also destroy them. The added work of both formation and destruction probably leads to the enlargement (Piney). Destroying the spleen by irradiation will in a measure destroy a very important agent in the successful treatment, namely, destruction of white cells.

Symptoms are often of great value in determining the prognosis. It has been our experience to obtain poor roentgen response in patients showing an elevation of temperature. All of our cases having an elevated temperature died very promptly. The blood count was influenced for only a short time and then not to any great extent. Two patients recently treated by roentgen irradiation had temperatures ranging from 100° to 105°F. One patient had a temperature of 106°F. just prior to death. The two patients entered the hospital at about the same time, during the Spring of 1931. The differential white count showed a high percentage of myeloblasts with a very low hemoglobin. The red counts were below 3,000,000.

It has been our experience to expect poor results in patients having a low hemoglobin. These patients were treated with the roentgen rays but responded poorly. In both cases the white blood count decreased for a time, but rapidly increased with many pathological cells, especially myeloblasts. The patients were each treated four times but showed no improvement and died promptly, one in June and one in July. We believe the differential counts were of great value in the prognosis of these two patients. Certainly from the blood findings, unusually low hemoglobin, low red count, relatively high white and a very high percentage of myeloblasts, poor results were to be expected.

Two patients treated over a period of five years gave blood findings quite the opposite:

Male patient, aged forty, came to the hospital on March 27, 1926, for roentgen therapy. White count of 300,000; hemoglobin 85 per cent; red count 4,070,000; polymorphonuclears 32 per cent, lymphocytes 10 per cent, myelocytes 58 per cent. His general condition was quite satisfactory. The patient felt well and was working each day. His chief complaint was the large spleen which occupied practically his entire abdomen. At the time of treatment he had no fever.

Roentgen therapy was instituted and he showed prompt improvement. After five treatments at infrequent intervals from March 29, 1926, to July 15, 1927, his white count dropped to 20,800 and the spleen was practically normal in size. The patient said, using his own words, "I feel wonderful." The patient left Chicago and we did not see him again until April 19, 1929, when his white count was 220,000; red count 2,890,000; hemoglobin 50 per cent, polymorphonuclears 35.5 per cent, lymphocytes 3 per cent, basophiles 5.5 per cent, premyelocytes 23 per cent, metamyelocytes 20 per cent, myeloblasts 10 per cent, eosinophile myelocytes 3 per cent. The spleen was greatly enlarged and the patient looked badly. The temperature was normal. The patient was given seven roentgen treatments over the chest, anterior and posterior, alternating, and on June 19, 1929, the count was as follows: red count 4,080,000, white count 6,000, hemoglobin 57 per cent, polymorphonuclears 66 per cent, lymphocytes 13 per cent, monocytes 7 per cent, eosinophiles 3 per cent, basophiles 5 per cent, metamyelocytes 5 per cent, premyelocytes 1 per cent. The patient was not treated again until February 5, 1930. Counts were made at frequent intervals, during which time the hemoglobin increased to 75 per cent, with marked improvement in the differential count. At no time during this period did the blood show myeloblasts.

On November 14, 1930, the count was as follows: red count 3,710,000; hemoglobin 60 per cent, white count 24,500, polymorphonuclears 25 per cent, metamyelocytes 15 per cent, premyelocytes 20 per cent, eosinophiles 2 per cent,

basophiles 19 per cent, lymphocytes 5 per cent, myeloblasts 14 per cent.

The patient's spleen was very large, he was cachectic and weak. We were of the opinion that the end was nearing and so informed his wife. We gave him four additional treatments, more to satisfy the patient than with the idea of doing him any good. His last treatment was given March 23, 1931. The patient having relatives in New York City wished to go there, so we referred him to Dr. LeWald, who saw him and felt, as we did, that nothing further could be done for him, and on April 13, 1931, he died.

We believe this case demonstrates conclusively the efficacy of roentgen therapy and also the great aid differential blood counts are in prognosis. (The counts in the case were made by Dr. Yaffe.) This patient showed a high white blood count, fairly normal red blood count and a satisfactory hemoglobin and no elevation of temperature at the beginning. Also the differential count, although showing numerous pathological cells, failed to show the presence of myeloblasts in large numbers. For a long period following therapy there was an absence of myeloblasts—when the myeloblasts appeared in the blood the patient's condition was serious and his response to therapy was insignificant.

The rays did not cause the maturation of the cells as formerly. As Isaacs says, the myeloblasts instead of maturing into myelocytes—metamyelocytes, etc.—divided into more myeloblasts. Whether or not this patient's life was lengthened I cannot say but I am sure his life was made more comfortable and he was able to work up to four months before death.

The second patient, a woman, aged forty-five, treated since January, 1928, shows the value of the differential blood count in the prognosis of these patients. The original count was as follows: red blood count, 4,070,000; white blood count, 192,000; hemoglobin, 60 per cent; coagulation time, 2½ minutes; polymorphonuclears 42 per cent; myelocytes, 56 per cent; eosinophiles 2 per cent. The patient was in good physical condition, temperature normal, spleen was enlarged but not hard.

During the past three years treatments have been given as was deemed necessary, being guided by the blood count. For periods of six months the patient felt very well, the count remaining under control. During the past three years there have been no myeloblasts present in the differential counts. Up to August 8, 1931, the patient has remained quite well. There would be an occasional sudden rise in the white blood count, accompanied by enlargement of the spleen, but never any myeloblasts.

The blood picture on August 8, 1931, was as follows: hemoglobin, 63 per cent; red blood count, 4,500,000; white blood count, 20,400; polymorphonuclears, 62 per cent; small lymphocytes, 4 per cent; large lymphocytes, 2 per cent; eosinophiles, 3 per cent; basophiles, 1 per cent; transitionals, 13 per cent; eosinophile myelocytes, 3 per cent; myelocytes, 12 per cent.

The last week in August the white blood count increased to 120,000 and there were 9 per cent myeloblasts present in the differential count. This is the first time during the course of the three and a half years' treatment that myeloblasts were found. The spleen on examination was considerably enlarged and quite hard and tender on palpation. The patient was having considerable gastrointestinal disturbance probably due to pressure. She was unable to lie on her left side due to the tender and enlarged spleen.

We are now concerned about this patient's further response to irradiation. Does the presence of the myeloblasts mean the end is near? It is our experience that with the increase in white blood cells the chance for further response is better than if there is a low white count with the appearance of the myeloblasts. We always feel more hopeful if there is an occasional increase in the white count. If the count remains low or continues to fall, we always fear the possibility of aplastic changes. The fact that the count occasionally increases, we believe, demonstrates the ability of the bone marrow to make blood, whereas if the white count continues to fall the marrow has been destroyed and the chance for any improvement is nil. Some of our cases have done this in the terminal stages. I have seen patients treated by the cross fire method over the spleen show a drop in the white

count from 100,000 to 2,000 and promptly die in spite of blood transfusions.

Only recently we treated a patient who was anxious to get to her home which was out of the state. We had treated her for two years at infrequent intervals with quite favorable response. During this time in the hospital we had given her two treatments and the white count had dropped to 60,000. Due to the fact that she was anxious to go home the attending physician was desirous that she have another treatment. We hesitated, stating we believed the count would show a further decrease from the last treatment, but finally agreed to give her another small dose. The treatment was given and the patient returned to her home in Iowa. Her count kept dropping, she became very weak and finally with the white count at 3,000, she was transfused four times and only after months did she regain her strength. Some months later, May 5, 1931, she came in for examination and the count was as follows: red blood count, 3,530,000; white blood count, 15,400; hemoglobin, 70 per cent; lymphocytes, 13 per cent; monocytes, 12 per cent; neutrophiles, 42 per cent; eosinophiles, 2 per cent; basophiles, 2 per cent; band shaped, 10 per cent; myelocytes, 15 per cent; metamyelocytes, 4 per cent.

PLAN OF TREATMENT

It has been our practice to treat all our patients with myelogenous leucemia over the chest, never cross firing the spleen. In most cases we avoid the spleen and only occasionally do we try to irradiate part of the spleen. We have been following this plan for ten years. We were prompted to adopt this procedure following the rapid drop in the white count and death, following cross fire irradiation of the spleen. I am free to admit that during the time we were irradiating the spleen, careful counts were not made as in recent years. Our results or at least the improvement following irradiation of the chest, have, we feel, been quite satisfactory so we have continued the practice. Some years ago we tried the method on a case which did not respond to irradiation of the spleen or long bones and, possibly luckily, she made a prompt response, and we have followed it since. We believe it is a mistake to destroy the spleen which has two distinct functions, namely, forming blood and also destroying blood. To destroy the spleen certainly removes these two very important functions essential to the well being of the patient. The bones of the chest are rich in marrow throughout life; possibly this is one reason the response is favorable. Also the chest contains larger amounts of blood and the direct irradiation of the blood may cause favorable changes in the circulating leucocytes.

The patient after a careful blood examination is treated over the anterior chest, using short wave radiation. Blood counts are then made daily and no further treatment is given as long as the count continues to fall. If the count fails to decrease the treatment is resumed, applying it to the posterior chest. If after a marked drop in the white count there is an appreciable increase in the count the treatment is again instituted. It has been our policy to give as little treatment as possible, in this way preserving the blood-forming apparatus.

We have also observed that many patients reach a point where they feel quite well, with the white count at a certain level. If the count is forced below this point they complain of feeling poorly. This fact has been noticed in a number of instances, therefore we have tried to find the point where the patient feels the best and do not try to get the white blood count lower.

SUMMARY

1. Myelogenous leucemia is a disease of the blood-forming apparatus, of unknown etiology.

2. The differential blood count is of great value in prognosis and in selecting cases for irradiation.

3. Irradiation is of great value and usually causes a marked improvement in the patient's condition, adding to his usefulness and working days.

4. It is problematical whether irradiation prolongs the life of the patient.

5. We believe that irradiation of the chest produces the best results.*

* For discussion see page 100.

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CLINICAL AND RADIOTHERAPEUTIC CONSIDERATIONS OF FOLLICULAR LYMPHOBLASTOMA*

By NATHAN ROSENTHAL, M.D., WILLIAM HARRIS, M.D., and ALBERT KEAN, M.D.
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OUR present knowledge with respect to the various disorders affecting the lymph nodes lacks precision and consistency and can be rendered of greater scientific value by clinical and pathological study of large groups of cases. The latter is at present of greater importance for recognition of the various types of disorders because of their similarity in symptomatology at the onset. In the future it may also be important for pathologists to agree concerning the various pathological lesions and their variations.

Clinically, lymphadenopathy may be classified into two main groups: (1) the benign, and (2) the malignant or non-curable. In the benign, it is important to rule out tuberculosis, syphilis, and infectious mononucleosis (glandular fever). In tuberculosis and syphilis the condition is usually localized, and rarely generalized. Fever is rather uncommon. The blood picture may not be helpful in differentiating the disorder and reliance should be placed upon a previous history of tuberculosis, or less rarely, of lues, together with the presence of the underlying condition in organs other than the lymph nodes.

Infectious mononucleosis may simulate malignant disease of the lymph nodes, and its symptoms should likewise be borne in mind. It usually affects young individuals and is accompanied by fever, generalized lymphadenopathy especially involving the cervical glands, and splenomegaly, subsequently followed by sore throat or abdominal symptoms. All of these may subside rapidly, or the lymphadenopathy may persist for several months together with a long-continued subfebrile period. The recent heterophile antibody reaction of Paul and Bunnell[6] is an additional aid in the differentiation of infectious mononucleosis from other disorders associated with lymphadenopathy.

We have had the opportunity of studying 156 cases of malignant lymphadenopathies during the past ten years. In each, the diagnosis was made by means of a biopsy as well as clinical studies including the blood picture. Only in isolated cases is the diagnosis possible by clinical symptoms alone. The blood picture may be identical in various groups, although in certain forms of Hodgkin's disease the diagnosis may be suggested by the presence of the eosinophilia and monocytosis. Such blood changes, however, have been found in other types.

Pathologically, the numerical distribution of the cases was as follows:

1. Hodgkin's disease or lymphogranuloma—80 cases
2. Lymphosarcoma (small or large round cell type)—50 cases
3. Reticulum cell sarcoma—16 cases
4. Follicular lymphoblastoma—10 cases

This communication will be limited to the pathological, clinical and radiotherapeutic features of the last mentioned type of lymphosarcoma, i.e., follicular lymphoblastoma (Baehr, Klemperer and Rosenthal[2]), previously described as "giant lymph-follicle hyperplasia of lymph nodes and spleen" (Brill, Baehr and Rosenthal[4]).

A thorough review of the literature, prior to the above publications, fails to reveal any comprehensive report on the clinical manifestations or radiosensitivity of this subvariety of lymphosarcoma.

Becker,[3] in 1901, reported a case somewhat resembling this disease, in which a hyperplastic condition of the lymph nodes was mentioned. Marked improvement followed the administration of arsenic. In an

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extensive report on lymphosarcoma by Ghon and Roman[5] in 1916, the disorder is described as a true malignant disease of the lymph glands spreading through the lymph

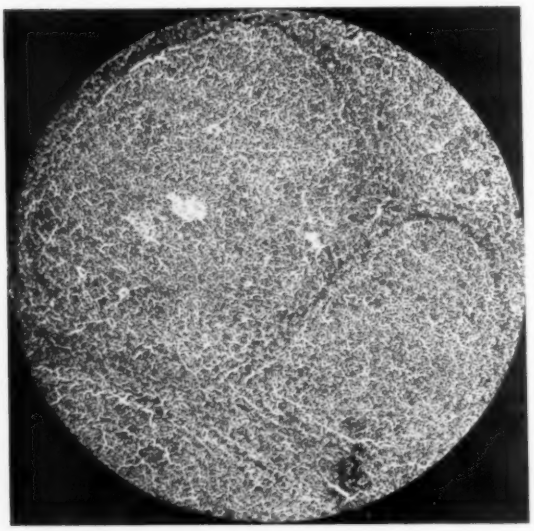

FIG. 1. Lymph node showing characteristic giant follicles. (×60.)

channels both by contiguity, direct and retrograde, and also through the blood stream. These investigators differentiated three histological types: (1) a variety in which the small and large cells are prevalent, corresponding to the Kundrat type; (2) a form in which the reticulum cells prevail, now known as reticulum cell sarcoma, (confirmed by further studies of Roulet[7]), and (3) a variety in which the large cells are prevalent and are regarded as lymphoblasts. Ghon and Roman likewise directed attention to the presence of large follicles in the third form.

No further mention was made of this last mentioned variety until Brill, Baehr and Rosenthal[4] reported 3 cases of follicular lymphoblastoma and pointed out the histological features of the lymph nodes and spleen and some of the clinical aspects. At the time of that report, however, the evolution of the disease into a malignant form was unknown.

Symmers,[8] in 1927, reported 3 additional cases and stressed the relative benignity of this condition.

The pathological findings have been further studied by Baehr, Klemperer and Rosenthal,[2] and a more comprehensive clinical and pathological description of the disease was presented by Baehr in May, 1932, before the Association of American Physicians which will be published in the Transactions of that Association.[1]

PATHOLOGICAL FINDINGS

If a biopsy is done in the early stage of this disease, enormously enlarged lymphoid follicles are found which resemble markedly overgrown germinal centers (Fig. 1). These follicles are composed of lymphoblasts and frequently show mitotic figures. The periphery of the follicle is composed of the small lymphocytes with darker staining nuclei. These morphological and histological findings are characteristic and are of special interest now when so much stress is being placed upon the grading of tumors with its bearing on radiosensitivity and prognosis.

Follicular lymphoblastoma may be mistaken for simple follicular hyperplasia. However, careful study readily differentiates the former by the presence of mitotic figures, by the large size of the follicles, and by the tendency to involvement of the fibrous capsule. The tissue does not resemble Hodgkin's disease histologically. It may be differentiated from aleucemic lymphadenosis by the remarkable follicular hyperplasia.

In a later stage of this disease, in addition to the characteristic follicular condition, some areas may show a disruption of this formation and a rather typical picture of lymphosarcoma with infiltration of the capsule and at times invasion of surrounding structures. The spleen, which is usually greatly enlarged, shows a similar characteristic follicular hyperplasia.

HEMATOLOGY

Blood studies on patients with follicular lymphoblastoma fail to show any characteristic changes other than terminal sec-

ondary anemias. In a few instances, marked enlargement of the spleen was accompanied by anemia. A marked monocytosis was also occasionally found.

CLINICAL COURSE

This is characterized by its long duration; one patient is still living after fourteen years. Although this disease is an expression of generalized involvement of the lymph nodes, its onset may manifest itself as a local condition. Unilateral exophthalmos was the first symptom noted in 2 patients. It occurred in 2 others later in the course of the disease, and curiously enough only in females. Naturally, this has little significance in a series of but 10 patients.

Enlarged regional nodes, either cervical, inguinal or axillary, may be the first sign of disease. Enlargement of the spleen, of the mediastinal nodes, retroperitoneal deposits, or direct invasion of other organs, such as the ovary or breast, may be seen either early or late in the disease.

Involvement of the chest may simulate acute pulmonary disease or circulatory embarrassment. One patient (Case 11) was brought to the hospital with a temperature of 104° F., with dyspnea, cyanosis, and a cough, the entire picture resembling pneumonia. Another patient presented the typical picture of a gastric neoplasm with nausea, vomiting, pain and loss of weight (Case x) (Fig. 2).

Pathological fracture of the femur (Fig. 3) occurred in one patient ten years after the onset of the disease. This patient had four operations by different surgeons before the true nature of the disease was ascertained.

Terminally, the body may be riddled by disease, voluminous tumor deposits occurring which give rise to pleural effusion and ascites. Skin infiltrations have also been noted.

A brief outline of the chief symptoms and progress of the disease are summarized in the table.

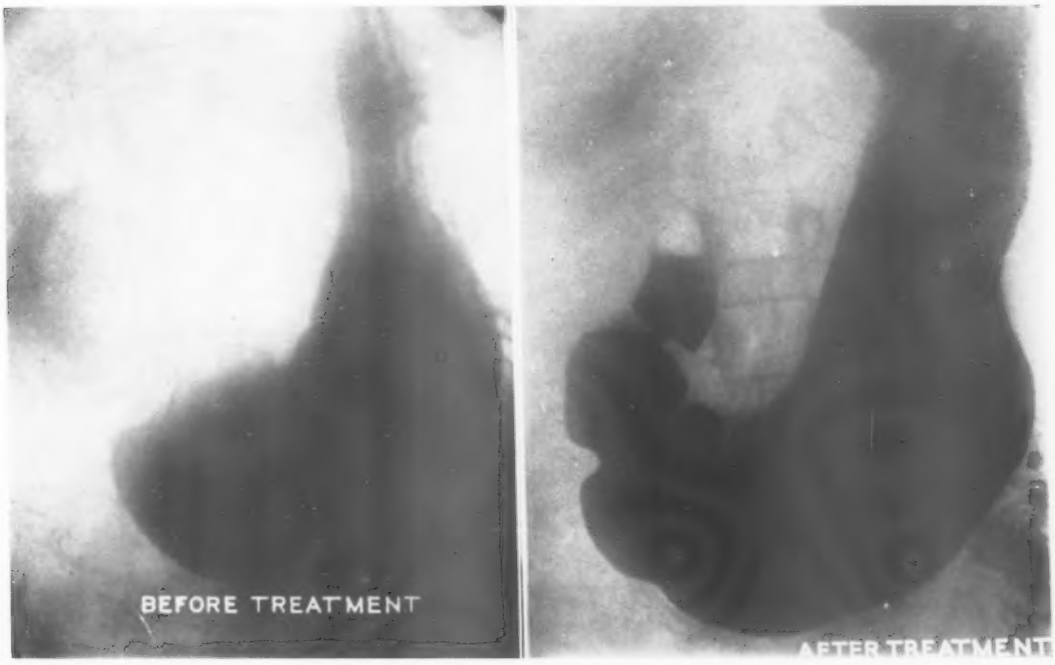

Fig. 2. Case x. Left: Extrinsic mass pressing upon the prepyloric area of the stomach causing an apparent filling defect in this area. Right: Normal appearance of the stomach after treatment and disappearance of the mass.

RÉSUMÉ OF CASES OF FOLLICULAR LYMPHOBLASTOMA

Case No.	Name	Age at Onset	Year of Onset	Chief Symptoms and Progress of Disease		Reaction to Radiotherapy	Result
I	H.M.	56	1920	Growth in cheek Exophthalmos Breast Generalized involvement Pathological fracture	1920 1922 1928 1930 1930	Very radiosensitive	Died 1931. Generalized involvement
II	R.M.	51	1918	Lymphadenopathy Exophthalmos Lymphadenopathy Mediastinal deposits Subcutaneous nodules	1918 1921 1922 1929 1932	Very radiosensitive	Asymptomatic 1932
III	S.B.	28	1923	Generalized adenopathy Splenomegaly Pleural effusion Pelvic adnexal invasion Exophthalmos Generalized involvement	1923 1923 1924 1925 1927 1930	Very radiosensitive	Died 1930
IV	E.S.	32	1923	Lymphadenopathy Splenomegaly (Splenectomy) Pleuropulmonary involvement Exophthalmos Cutaneous nodules Generalized involvement	1923 1923 1925 1925 1926 1926	Very radiosensitive	Died 1926
V	S.S.	44	1927	Lymphadenopathy Splenomegaly Generalized involvement	1927 1931	Radiosensitive during first 3 years of disease	Died 1931
VI	J.W.	32	1927	Generalized adenopathy Ascites Pleural effusion	1927 1927 1927	Treated for 1 week before exitus	September, 1927, died 1 week after admission
VII	I.N.	44	1928	Inguinal glands No spleen	1928	Very radiosensitive	Asymptomatic 1932
VIII	P.E.	31	1928	Intra-abdominal mass Spleen enlarged Exploratory laparotomy	1928	Very radiosensitive	Asymptomatic 1932
IX	I.J.	46	1929	Enlarged inguinal glands Generalized adenopathy Hepatomegaly, splenomegaly Enlarged hilus glands Scattered infiltrations in both lungs.	1929		Died 9-17-31
X	I.A.	56	1929	Mass in epigastrium Enlarged glands in left axilla Left pleural effusion	1929 1929 1929	Very radiosensitive	Asymptomatic 1932

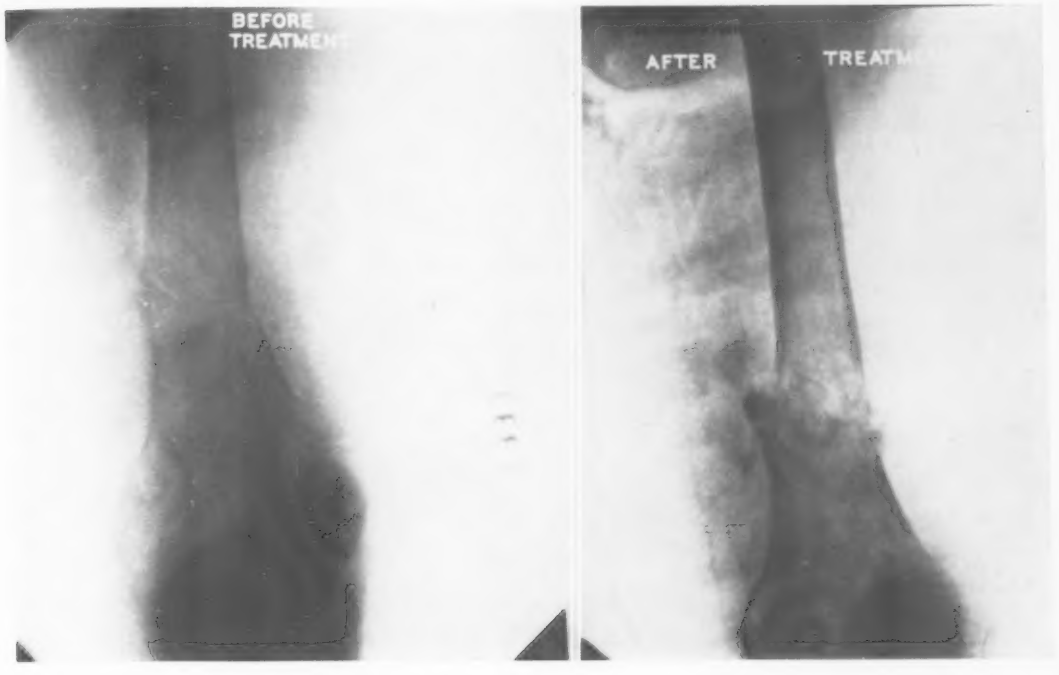

FIG. 3. Case 1. Left: Pathological fracture through femur at junction of the middle and lower thirds. Note marked rarefaction of the femur at the site of the fracture particularly in the proximal fragment. Right: After treatment; note the marked amount of callus.

RADIOTHERAPY

There is probably no other pathological entity which responds to radiotherapy, even with small dosages, so readily as follicular lymphoblastoma. Fractional doses of high voltage roentgen therapy (180–200 kv.) are employed. The average dose is about 200 r. All of the involved areas are treated at about three or four day intervals. As a rule, a test treatment of about 125 r is employed at first. This procedure was adopted after learning of an accident which occurred in the treatment of a case of exophthalmos due to follicular lymphoblastoma. This patient was given a massive dose to the eye through three fields at one sitting. On the same evening there was a severe reaction about the eye with marked proptosis necessitating enucleation of the eyeball.

All the patients with exophthalmos who received this fractional dosage were treated successfully. Only one required a second series of treatments to the eye. In one patient (Case 1) exophthalmos of the right eye occurred several years after the left; both responded promptly to irradiation.

The lesions throughout the body responded readily until the terminal stage of the disease, when they became radioresistant. In several instances radium packs induced regression when roentgen therapy failed.

SUMMARY

1. Attention is called to the clinical, pathological and prognostic characteristics of follicular lymphoblastoma. This condition is associated with generalized adenopathy and usually splenomegaly.

2. Microscopically, it may be differentiated from other forms of lymphosarcoma by the unusual giant follicle formation.

3. In four cases, exclusively in women, exophthalmos occurred during the course of the disease.

4. The prognosis with respect to longevity is more favorable than in other forms of lymphosarcoma.

5. Follicular lymphoblastoma is markedly radiosensitive.

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DISCUSSION OF PAPERS BY McALPIN AND GOLDEN, JENKINSON, AND ROSENTHAL, HARRIS AND KEAN

DR. THOMAS FITZ-HUGH, JR., Philadelphia. I have little to add to this discussion, except to express my thanks for the opportunity of listening to these papers.

In regard to the paper by Dr. McAlpin and Dr. Golden, I would like to ask one or two questions: whether they have found any means of alleviating the tremendously distressing bone symptoms that sometimes develop in the course of Hodgkin's disease, and in the lymphosarcoma group occasionally, due apparently to subperiosteal involvement.

One other, perhaps unrelated, remark from the hematologic standpoint in regard to Hodgkin's disease. As everyone knows, there is no clear-cut hematologic picture. Occasionally, however, one sees some very remarkable leucomoid blood reactions in Hodgkin's disease which merely complicate the diagnosis.

One of the most interesting cases we have had at the University Hospital in the past few years was a woman who had been afflicted for about five years with remissions and relapses of lymph node enlargements, and who came to us in a terminal state, with a blood picture that was most unusual. She had about 80,000 leucocytes, of which 80-odd per cent were adult eosinophiles. This case has been reported by Dr. Stewart under the title of "Eosinophilic hyperleukocytosis in Hodgkin's disease." The diagnosis could only be made by biopsy and I think it took Dr. Herbert Fox some time to arrive at a conclusion. The final diagnosis of Hodgkin's disease was made on the basis of the typical Dorothy Reed cell.

Dr. Jenkinson's experiences with myelogenous leucemia are in line with the experience of most workers in this field in regard to the prognostic implications of the so-called "acute" pictures in the blood. It has long been recognized that the myeloblastic blood picture carries a bad prognosis and the myelocytic blood picture a relatively better one. I think the only general exception that one might take to Dr. Jenkinson's presentation is his apparent fear of irradiating the spleen. I believe the spleen can sometimes be irradiated with safety and with benefit in this disease. We have seen complete remissions of myelogenous leucemia under Dr. Pancoast's and Dr. Pendergrass' management. I have the pleasure of following their cases and I have seen patients with myelogenous leucemia in a florid state of the disease with hundreds of thousands of leucocytes in the blood and huge spleens and marked anemia come back week after week and finally reach a stage where their blood count is completely normal, where I would defy any hematologist to find a distinctive abnormal cell in it, where the spleen has vanished under the ribs, and where the patient could pass any life insurance examination that I know of, unless he told his story. Of course, that sort of remission isn't always obtained and doesn't last forever. It lasts from a few months to a year at best and then relapses. After several such remissions and relapses the therapy becomes ineffective.

Ever since Dr. Brill and Dr. Rosenthal reported on that interesting disease they established some years ago we have been on the lookout for it. I am still hoping to see a case. It represents apparently a very interesting subgroup under that medley of diseases that are perhaps related, namely, Hodgkin's disease, leucosarcoma, lymphosarcoma and lymphatic leucemia.

Dr. Herbert Fox, Philadelphia. This has been to me a very interesting series of papers and they touch upon a great variety of questions concerning the basic pathology and reason for this group.

With regard to Dr. Jenkinson's paper, the points that I jotted down first concern the discovery of changes in the myeloid cells by examination of the saliva. In the group of cases in which I was interested some years ago, following the myeloid cells in saliva, I found that it was not a very practical method of controlling the course of the disease, but the results were more dependable if the saliva were clean and alkaline. Too often in myeloid diseases there is an infection of the mouth, and a decomposed or acid saliva; with that there are decomposed cells.

There is some difference of opinion or difference of statement by Dr. Jenkinson from an article recently appearing in the *Journal of the American Medical Association*, Sept. 19, by Hoffman and Craver, in which there is a distinct difference of treatment in the myeloid diseases. That has something to do with the method of treatment that concerns also the lymphoid diseases, of which I will speak later. But we will say now he is stating that a continuous observation, not temporary observation, is for the purpose of reducing myeloid cells, but a continuous observation may have a still different result in the control of myeloid cells in blood than the intermittent treatment.

Dr. Jenkinson objects to the thought, or at least questions the thought, of the removal of the spleen in myelogenous leucemia. It is a procedure to which considerable thought should still be given if for no other reason than the very favorable or hope-giving statistics of Dr. Mayo about three years ago from the Mayo Clinic, that cover some 40 or 50 cases.

One of the latest statements of Dr. Jenkinson was "as little treatment as possible." I should say as well distributed treatment as possible, and continuous.

Dr. McAlpin's paper on Hodgkin's disease reminds me, first, of the classification that is as yet unsettled in that group of lymphadenopathies. It is known to all of us that there are two main groups, possibly three, of typical Hodgkin's disease; first, the isolated, single gland group of cellular type; second, the tumor-forming type that grows rapidly into the pyramidal neck, and the massive formation of tumors within the chest and abdomen. As a possible subgroup, perhaps belonging to the first of the two, is the sarcoma group or at least that group of cases that pass into a sarcoma stage rather early. It is evident that we have one of two reasons for them, either a difference in virus or difference in soil, and judging by recent experience of experimental leucemia in the lower animals, it looks as if it were difference in soil. Obviously then a difference of treatment must be considered. By this same token if it be the difference in soil, the virus is constantly working and is the same, and if it be difference in soil, there must be difference in treatment. But it must be the same kind of treatment continuously going on.

All of you who have seen sections of biopsy of Hodgkin's disease are aware that as subsequent biopsies are made the original type of tissue is repeated; therefore, the virus is going on. It must be the case then that a continuous treatment in between times must be carried on if these uncaught foci are to be caught.

In looking over my records before coming down here, I find 3 cases very closely comparable to Dr. McAlpin's, one of which lasted seven years, and the other two about five years. In none of them was any surgery done. I am not sure that surgery is a suitable thing to carry out.

As far as Dr. Rosenthal's paper is concerned, I find myself somewhat confused. There have been recognized for many years various forms of pseudoleucemia or aleucemic leucemia, or what you will. Five or six years ago Drs. Brill, Baehr and Rosenthal described a follicular hyperplasia that had been reported once before and was subsequently described by Dr. Douglas Symmers of Bellevue, and this group of cases, I think making 7 or 8 or 9 all together up to the time of Symmers' paper, were relatively benign, easily handled and scarce.

As Dr. Fitz-Hugh has stated, we have been unable to see anything closely comparable, yet Dr. Rosenthal's description today and the notes that he was good enough to send me suggest more closely chronic lymphomatosis described by the French, admitted by the American and English authors, yet closely allied to lymphosarcoma, of which there are copious examples, not only in the literature, but in the experience of all of you, I am sure, a disease of widespread character, similar to Hodgkin's disease, similar to lymphosarcoma but not similar to leucemia. I would be very glad if Dr. Rosenthal would straighten me out as to whether he

means the acute and subacute follicular hyperplasia he described in the *Journal of the American Medical Association* five or six years ago, or whether he means generalized lymphomatosis of the French, lymphoblastomatosis of our literature. We have been feeling at the University of Pennsylvania a very distinct need for separating this particular thing from lymphosarcoma and from Hodgkin's disease.

I was thinking about it coming down on the train and I made a separation in my mind and on paper as to what these three things are. Lymphomatosis is a multiple tumor of lymph nodes and of viscera, with or without an enlargement of the spleen, more often without, and with a tendency to involvement of the bone, such as Dr. Rosenthal has mentioned here. Lymphosarcoma has none of the common characteristics. There is no reduction of neutrophiles, as there is in leucemia. There is no characteristic enlargement of the spleen; there is no involvement of the skin; there is no involvement of the bones characteristic of it, though accidentally possible, and no distinctive involvement of the lungs. Hodgkin's disease of the sarcoma type has no characteristic enlargement of the spleen, although it is usually large. Skin involvement is common; bone and lung involvements common.

Here is a rapidly made separation, to be sure, but I feel that we must give credence to the thought that there are special groups of cases.

Finally, the last question is, is it necessary to make a separate classification for each one of these? Dr. Desjardins shakes his head no. He is influenced probably by the late Dr. Warthin and others of the group who believed they all may be put in the lymphosarcoma group. If we are to find the cause, if we are to get further in our knowledge of this very obscure group of cases, it would seem better to make such separations as I have just suggested, with the hope of getting closer to the reasons. There must be something very definite, intimate and important in the human being to have such groups of cases, so definite and yet inseparable, and yet so clearly related, because they do not exist as such a varying group of diseases among the lower animals.

DR. A. U. DESJARDINS, Rochester, Minn. Dr. Fox saw me shaking my head when he asked whether or not it is necessary to separate these different groups. From the standpoint of treatment, a distinction is not at all necessary, because the treatment is roughly the same regardless of the form of the disease. Of course, the treatment must be adapted to the circumstances of each case and adjusted to the individual patient; otherwise the general scheme of treatment is the same.

With reference to etiology, I do not know more than anyone else, but I have reviewed several hundred histories of cases of this kind, especially the Hodgkin's-lymphosarcoma group. The more I see of such conditions and the more I question patients, the more prominent the theme of chronic infection appears. In a small percentage, tuberculosis apparently plays a definite part, but it is only a relatively small percentage. In the larger number chronic infection around the teeth, nasopharynx, and respiratory tract seems to be the main etiologic factor, and in a small group the disease seems to arise from the gastrointestinal tract. I have seen a number of cases in which the main symptoms were gastrointestinal; some of them were operated on, on the clinical assumption of gastric ulcer, and a lymphoblastomatous lesion in the stomach was found.

Another point refers to the value of treatment from the diagnostic point of view. Of course, this applies especially to cases of mediastinal lymphadenopathy, with or without enlarged nodes elsewhere. Often a biopsy is not feasible, and such cases are referred to test the reaction to treatment, because in over 90 per cent of cases, the diagnosis of lymphogranuloma or lymphoblastoma by the reaction to treatment can be established within from a few days to two or three weeks. There may be a few exceptions, but the vast majority can be readily distinguished in this way.

Another point is the tendency of some radiologists to concentrate the treatment too much, especially in bad cases. Patients differ greatly in the relative acuteness or chronicity of the disease. If some who give a relatively short history are followed, it will be found that the course of the disease is relatively short. On the other hand, others will be found, who, even without systematic treatment, may go on for years. I know patients who have gone eight, ten, thirteen, sixteen years, and one case twenty-five years from the onset of symptoms until death, and these patients had had no systematic treatment of any kind. In dealing with the more acute case, care must be used in applying the treatment. Instead of improving the condition of the patient, too concentrated treatment may rapidly make it worse. This

may or may not apply to certain cases with marked manifestations. Here again considerable judgment must be used, because the degree of clinical manifestations does not necessarily correspond with the course of the disease, although it usually does.

Many patients present enormous packs of nodes in the neck or axilla, sometimes even in the abdomen. Well-planned treatment may have a tremendous and rapid restorative effect, whereas if the treatment is pushed too much, life may actually be shortened.

Sometimes an apparently moribund patient may be restored to normal health or his condition may be improved for several months or several years. For instance, I remember one patient, a business man from New Zealand, who was on his way to London on business. He had had Hodgkin's disease for five years and said that whenever he didn't feel very well, he went to his radiologist and "got a shot." The year before he left New Zealand he had been well enough to play through a series of tennis championship matches. Therefore, he couldn't have been very ill at the time. When he arrived in San Francisco, he was quite sick and when he arrived at Rochester he was almost dead; he could barely breathe. His cervical lymph nodes were enormous, his axillary nodes were so large as to prevent his bringing the arms to the sides; the enlargement of the retroperitoneal and abdominal nodes was plainly visible. One pleural cavity was entirely filled with fluid. When I first saw him, I was on the point of declining to treat him; he was so very ill. However, withdrawal of over two and a half liters of fluid from the pleural cavity relieved the dyspnea considerably. Treatment was then started in short daily sessions. Gradually the rest of the fluid disappeared. As the mediastinal nodes diminished in size, the other nodes also melted away. In two months he was on his feet and in three months he was well enough to journey to Europe, where he spent the summer. He died later, but I mention the case to show that by cautious treatment much may be done, even when the clinical circumstances appear decidedly unfavorable.

I should like to mention two more points. When such patients have fever, they usually have enlarged retroperitoneal nodes. The reason for this conclusion is that when treatment in such cases is confined to the abdomen from front or back, or both, the retroperitoneal nodes diminish in size, and the fever generally disappears in a relatively short time. This also applies to toxic cutaneous manifestations. In many cases with general or local toxic manifestations in the skin, if the retroperitoneal nodes are treated, the cutaneous manifestations promptly clear up.

With reference to myelogenous leucemia, I have not tried the scheme of treatment advocated by Dr. Jenkinson, because we have had similar results by irradiating the spleen and also the long bones whenever necessary. The results obtained by Dr. Fitz-Hugh agree entirely with ours. Here again we find that judgment in planning the treatment according to the situation of the patient is often followed by marked improvement. For instance, when the patient presents a rather low hemoglobin and a low erythrocyte count careful treatment is usually followed by a fall in the excessive number of leucocytes, while the hemoglobin and erythrocytes increase at the same time, and the situation takes care of itself. This doesn't apply to all cases, but it is true for the majority. Therefore, even when the hemoglobin is comparatively low, providing it is not extremely low, we do not consider this a contraindication to treatment, but rather the contrary.

Dr. McAlpin (closing). To take up briefly some of the points brought out by the discussion. Dr. Fitz-Hugh mentioned two conditions which strangely enough we haven't encountered. I have never seen very marked eosinophilia in Hodgkin's disease, and I have never encountered bone pain. We have had some bone pain in our leucemias, but never to any great extent in Hodgkin's disease unless perhaps there was a definite nodule, which is a rather different story.

The different types of Hodgkin's disease which Dr. Fox mentioned brings up a very elaborate question and one which is difficult. I am willing to agree with Dr. Fox that these cases do separate into different groups and that is why sometimes we get such remarkably good results and other times such extremely unfortunate results.

The question of surgery. We have seen cases where surgery did seem to benefit. I don't really know whether it is worth while or not; sometimes it does seem to help.

The keeping in touch with the patients and the small doses over frequent intervals is, I think, of tremendous importance, not only when they have symptoms, but it is being in touch with them and anticipating serious symp-

toms which I think is the most important point of the whole therapy.

As far as the infective idea that Dr. Desjardins mentioned is concerned, I have always been one of Dr. Golden's followers—I may have lost faith frequently, but I always come back to the hope that this disease, Hodgkin's or lymphoblastoma, is an infection due to some organism we know nothing about. That is at least what we like to hope, because it does seem to open a field which otherwise would be closed.

DR. JENKINSON (closing). Regarding the treatment of the spleen, which seemed to be one of the points of issue, we have treated, of course, a number of these patients over the spleen and I am not prepared to say that it isn't the proper method or way to treat these patients, but in our hands I feel that we have obtained better results by treatment over the chest. As I said in my paper, I feel on account of there being so much red bone marrow in the ribs and in the vertebrae that possibly that accounted for what we think are better results.

Dr. Fox spoke about removal of the spleen. I imagine he meant from my paper removal by destruction through irradiation, as I didn't say, of course, anything regarding surgery. Possibly that is a method of treatment.

DR. FOX. I was talking about direct treatment of the spleen.

DR. JENKINSON. I thought you said removal.

DR. FOX. I did talk about removal in addition.

DR. JENKINSON. I didn't say anything about that in my paper. I also said as little treatment as possible. I still feel that that is the proper method. I would rather get these patients through, if I can get the results, with as little roentgen irradiation as possible without destroying any of the bone marrow. As to the distribution, again that is the point at issue. I don't doubt that a great many men are probably getting good results by treating over the spleen, but from our experience, we feel we get better results and better response by treating over the chest.

I also feel that in patients with fever our results have been poor. I don't know whether any of you have had that experience.

Regarding the saliva count, we tried it, as Dr. Fox said. We put these patients on alkaline mouth wash. Even then we didn't seem to get much information from the saliva counts.

Regarding Dr. Desjardins' remarks about hemoglobin, I still think that with a low hemoglobin (I won't say it is a contraindication), you don't get as good results as when the hemoglobin is high. I don't think relatively low hemoglobin makes much difference. Dr. LeWald just gave me the final count before death of the man I reported. His hemoglobin was down to 17 per cent, and I think that (at least it has been our experience) with a low hemoglobin, a high temperature, a high myeloblastic count, the results have been poor.

DR. ROSENTHAL (closing). In calling attention to this disease in 1924, a thorough search of the literature was made. A case of this particular condition was reported by Becker in 1901. As far as the other cases were concerned we surmised they were possibly dealing with this form of lymphoblastoma. In the communication by Ghon and Roman in 1916, lymphosarcoma is classified into three groups. At that time they considered this follicular form as a type of lymphosarcoma. However, their case histories are very meager and one could not draw any conclusions as to the clinical features.

Follicular lymphoblastoma is a definite clinical entity with characteristic clinical features and pathological changes. They may not be of as great importance to the radiologist as far as treatment is concerned, but the prognosis of this condition is far better than in other forms of lymphosarcomatosis. In our statistics of over 50 cases of lymphosarcoma the average duration is two years. In this particular disease at the present time, the average duration has been five years, but we are still following a number of patients who are alive, and I think the average duration will be much greater. There was one case that we followed for only two and one-half years, but otherwise the cases lived over five years.

Vol. XXIX, No. 1

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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Publisher: Charles C Thomas, 220 East Monroe St., Springfield, Illinois

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application: Editorial office, 110 Professional Building, Detroit, Mich. Office of publication, 220 E. Monroe St., Springfield, Ill. Information of interest to all readers will be found on page iv.

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EDITORIAL

THE NEED FOR COOPERATIVE ACTION IN DETERMINING THE POSITION OF ROENTGENOLOGY IN HOSPITALS

THE inertia of medical men in dealing with the economic phases of their own destinies has led non-medical bodies to attempt to dictate the forms medical practice shall take. This inertia has not been due to lack of interest on the part of physicians but to their reticence in letting it be known that medicine, while a profession, is also the only source of livelihood for most practitioners. This unwillingness of physicians to discuss the economic problems of practice has been used subtly by self-seeking non-medical organizations to advance their own interests at the expense of physicians. We have been told that to evince an interest in the financial aspects of practice is to be mercenary. Tacit acceptance of this doctrine has led to the conditions confronting us today.

For a long time physicians have been content to allow outsiders to direct; now they are attempting to dictate. We have failed to realize that the best interests of the public, as well as our own interests, demand that we take an active part in keeping the practice of medicine free of the stultifying effects which would follow its being fettered by politicians, professional sociologists or other selfish non-medical agencies.

Fortunately, we have at last awakened to our position. The minority report of the Committee on the Cost of Medical Care, the vigorous editorials of the *Journal of the American Medical Association*, the reported transactions of medical organizations throughout the country, the utterances of our leaders, all attest to this.

As a physician the roentgenologist has suffered all the impositions endured by all physicians, and, in addition, has economic problems peculiarly his own. In hospital practice roentgenology has become increasingly the prey of those seeking to exploit the physician.

The singleness of his position in hospital organization gives inadequate protection to the roentgenologist. Surgeons, internists, and other specialists have the protection coming from numerical strength. Singleness has left the roentgenologist defenseless when forced to carry on negotiations with laymen who, trained in business methods, fail to see the physician's point of view and consequently are not loath to exploit a physician when the opportunity arises.

The evil is not new, but it is growing. The time has come for formal recognition of its existence and for the taking of steps to stop it. This could not have been done earlier because in many places roentgenology was on the defensive and forced to battle with prejudices.

Roentgenology has proved its worth. It is no longer on the defensive. In practically all medical schools undergraduate instruction is now given in the specialty, and in most it is accorded a seat on the major faculty. But if roentgenology is to have her full measure of recognition, and roentgenologists the full rewards of clinical specialists, the leaders of the specialty must define the exact position roentgenology is to take and define the terms of service.

Our general medical organizations may be entrusted with the task of educating the public to the necessity of an unfettered medical profession. The task of roentgenology is to teach them that roentgenol-

ogists, too, must be given the incentives and rewards needed by all physicians, if further benefits are to be conferred on humanity by the specialty. General recognition of the importance of these facts will not only advance roentgenology, but it will also insure to the public and to hospitals the type of roentgenology to which they are entitled, the best.

Practically, it should not be difficult to bring this about. Roentgenology has powerful national societies devoted to her interests. These organizations should draw up a code which, by the palpable fairness of its principles, will be universally acceptable—acceptable to the public and to hospitals as well as to the roentgenologist. This code should define the position of the roentgenologist in hospital organization and the economic principles on which hospital appointments should be accepted. Committees entrusted with the formulation of this code should realize that united action was impossible earlier and should proceed with tact, avoiding any criticism of the terms under which individual roentgenologists have been obliged to accept appointments in the past.

Adoption of the code would mean that members of the organization would abide by it in the future.

The code should be promulgated, its adoption urged upon all hospital-approving agencies, and specific acceptance of it demanded by all candidates for membership in radiological societies.

The benefits of such a plan are numerous. It is far better for all, for the roentgenologist, the public and the hospitals, that the roentgenologist be dictated to by an organization of roentgenologists, rather than that he be subjugated and forced to accept the dictates of any non-medical outside agency.

To the public, acceptance of such a code would insure the highest type of roentgenology being practiced in hospitals. To the hospital, it would mean that the best available roentgenologist would accept its appointment. To the roentgenologist, it would mean the cessation of undignified unprofessional bargaining and the contentment which comes only with proper recognition.

The entire medical profession realizes the time has come when decision, study and action are necessary if we as physicians are to preserve our position. The time has also come when the roentgenologist by decision, study and cooperative action with his fellows can insure for himself the position to which he is entitled; delay means loss of an opportunity which may never come again.

John T. Farrell, Jr.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. E. P. Pendergrass, University Hospital, Philadelphia, Pa.
Annual Meeting: Chicago, Ill., Sept. 25–30, 1933.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual meeting: Chicago, Ill., Sept. 25–30, 1933.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. J. T Murphy, 421 Michigan St., Toledo, Ohio.
Annual meeting: Milwaukee, Wis., 1933.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N. Y.
Annual meeting: Chicago, Ill., Sept. 25–30, 1933.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, Dr. D. R. MacColl, 2826 S. Hope St., Los Angeles, Calif.
Meets on the third Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. C. H. Heacock, 20 S. Dunlap St., Memphis, Tenn.
Annual meeting: Richmond, Va., November, 1933.

BROOKLYN ROENTGEN RAY SOCIETY
Secretary, Dr. G. W. Cramp, 921 President St., Brooklyn, N. Y.
Meets monthly on first Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St., Buffalo, N. Y.
Meets second Monday of each month except during summer months, place of meeting selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. George M. Landau, 660 Groveland Park.
Meeting second Thursday of each month October to May inclusive at Virginia Hotel.

CINCINNATI RADIOLOGICAL SOCIETY
Secretary, Dr. H. G. Reineke, Christian R. Holmes Hospital, Cincinnati, Ohio. Meetings held monthly.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. M. A. Thomas, Medical Arts Bldg.
Meetings are held at 6:15 P.M. at the Cleveland Chamber of Commerce Club rooms on the fourth Monday of each month from October to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. E. R. Witwer, Harper Hospital.
Meets monthly on first Thursday from October to May, at Wayne Country Medical Society Building.

FLORIDA RADIOLOGICAL SOCIETY
Secretary, Dr. W. McL. Shaw, 418 St. James Bldg., Jacksonville, Fla.
Meetings held twice a year, May and November.

ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. L. M. Hilt, Myers Bldg., Springfield, Ill.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

MICHIGAN ASSOCIATION OF RADIOLOGISTS
Secretary, Dr. S. W. Donaldson, St. Joseph's Mercy Hospital, Ann Arbor, Mich. Three meetings a year, Fall, Winter, and Spring. Next Meeting, Hurley Hospital, Flint, Mich., January 31, 1933.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee, Wis.
Meets first Friday in October, December, February and April. Place of meeting designated by the president.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L. G. Rigler, University Hospital, Minneapolis, Minn. Next meeting, Minneapolis, Minn., February, 1933.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. C. W. Schwartz, 33 E. 68th St., New York.
Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. H. S. Bull, 604 Masonic Temple, Auburn, N. Y.
Three meetings a year—January, May and November.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Reiley, Clearfield, Penna.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Karl Kornblum, 3400 Spruce St.
Meeting first Thursday of each month from October to May inclusive, at 8:15 P.M., in Thomson Hall, College of Physicians, 19 S. 22d St.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. S. L. Warren, Strong Memorial Hospital.
Meets monthly on the first Friday evening at 7:45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary, Dr. W. K. Mueller, University Club Bldg.
Meets first week of each month. Time and place of meetings designated by president.

SOUTH CAROLINA X-RAY SOCIETY
Secretary: Dr. R. B. Taft, 105 Rutledge Ave., Charleston, S. C.
Meets at time and place of South Carolina State Medical Association. Next meeting, Spartansburg, April, 1933.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

UNIVERSITY OF MICHIGAN ROENTGEN RAY SOCIETY
Secretary, Dr. C. C. Taylor, University Hospital, Ann Arbor, Mich.
Meets first and third Wednesday evening of the month from October to June, at 8 o'clock in the amphitheatre of the University Hospital.

* Secretaries of Societies not here listed are requested to send the necessary information to the Editor.

Virginia Roentgen Ray Club
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Meets annually in October.

Cuba

Sociedad Cubana de Radiologia y Fisioterapia
Secretary, Dr. Luis Fariñas, Animas 110, Havana, Cuba.
Meets monthly in Havana.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 p.m., at 32 Welbeck St., London, W. 1., or as advertised.

Electro-Therapeutic Section of the Royal Society of Medicine (Confined to Medical Members)
Meets on the third Friday of each month during the winter at 8:30 p.m. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

Section of Radiology and Medical Electricity, Australasian Medical Congress
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Radiological Section of the Victorian Branch of the British Medical Association
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

Section on Radiology, Canadian Medical Association
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

Radiological Section, New Zealand British Medical Association
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch. Meets annually.

Continental Europe

Belgian Society of Roentgenology
Secretary, Dr. J. Boine, Avenue des Allies, 134, Louvain, (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

Societe de Radiologie Médicale de France
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Société Suisse de Radiologie (Schweizerische Röntgen-Gesellschaft)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

Société Francaise d'Electrothérapie et de Radiologie Médicale
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Association of German Roentgenologists and Radiologists in Czecho-Slovakia
Secretary, Dr. Walter Altschul, German University, Prague, 11/52.

Deutsche Röntgen-Gesellschaft (Gesellschaft für Röntgenkunde und Strahlenforschung)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

Süd-und Westdeutsche Röntgengesellschaft
Meets annually in different cities.

Nord- und Ostdeutsche Roentgengesellschaft
Meets annually in different cities.

Dutch Society of Electrology and Roentgenology
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

Societa Italiana Radiologia Medica
Secretary, Professor M. Ponzio, University of Turin, Turin.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banul Maracine 30 Bucarest, Rumania.
Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad, USSR, in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

Polish Society of Radiology
Secretary, Dr. Jan. Kochanowski, 45 Gornoslazka St., Warsaw. Meets annually.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with exception of the Denmark Society, meets every second month except in the summertime.

Society of Medical Radiology of Sweden
Meets in Stockholm.

Society of Medical Radiology in Norway
Meets in Oslo.

Society of Medical Radiology in Denmark
Secretary, Dr. G. Biering, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

Society of Medical Radiology in Finland
Meets in Helsingfors.

Vienna Society of Roentgenology
Meets first Tuesday each month, October to July.

Orient

Japan X-ray Association
c/o Orthopedic Surgery, Tokyo Imperial University.
Meets annually in April.

Kinki Roentgen-Abend Society
Director, Dr. Prof. Taiga Saito, Ogawaoike, Kyoto, Japan. Meets bi-monthly on third Sunday.

THE PROGRAM FOR THE AMERICAN CONGRESS OF RADIOLOGY

The American Congress of Radiology is to be held in Chicago, September 25 to 30, 1933, inclusive. This Congress is intended to take the place of, or rather, combine, the regular annual meetings of the American Radium Society, the American Roentgen Ray Society, the Radiological Society of North America and the American College of Radiology. This is done for the purpose of economizing time and expense and also to permit attendance at the Century of Progress Exposition.

It is planned to hold a Scientific Program during six days from 9 A.M. to 2 P.M., with an intermission of twenty minutes. The remainder of the afternoons and all of the evenings, except one, are to be left free for attendance at the Exposition, study of the scientific and commercial exhibits, and to permit the various societies to hold their executive sessions.

It is proposed to hold the Convocation of the American College of Radiology, under the management of the officers of this organization; the Convocation of the Radiological Society of North America, together with the award of their medals, under the management of the officers of this organization; to have a banquet and the Caldwell Lecture, arranged for by the officers of the American Roentgen Ray Society, and to have a lecture on one of the oustanding radium pioneers, under the management of the officers of the American Radium Society.

Because of the fact that the Scientific Program is being limited to four hours and forty minutes on six days, or a total of twenty-eight hours, which must include all discussions, addresses, introductions, etc., it is evident that the program must be somewhat limited and that every speaker must strictly adhere to his time, and this time must include the presentation of his paper as well as the presentation of lantern slides. In spite of this fact, the Program Committee and Council which are arranging this program, desires that so far as is practical, all new outstanding work be presented at this meeting. We are therefore asking the members of the various radiological societies to offer to the Committee any paper that will be helpful in making this Congress a great success, and I am asking also that each member who knows of some recent work that is being done to give us this information. Please make these suggestions as promptly as possible for in carrying out such an extensive program delays must be avoided.

GEORGE E. PFAHLER, *Chairman*
Committee on Scientific Program
1930 Chestnut St.,
Philadelphia, Pa.

PHOTOGRAPHY A VALUABLE HOBBY

To the Editor:

For a long time I have been aware that photography is one of the most valuable hobbies that a roentgenologist can cultivate. I do not know anything outside of physics and electrical engineering that is more useful to a roentgenologist, especially on the diagnostic side, than knowledge acquired through photography. For this reason it would seem highly desirable for a larger number of roentgenologists to become interested in photography as a hobby. I have also long been aware that among the members of the American Roentgen Ray Society are a number who are more or less expert in the science and art of photography. It has occurred to me that it would be most desirable to form, within the Society, a section on photography, and as a part of the annual exhibit to have a photographic exhibit also. This could perhaps be done most simply through a committee designated by the President. I am quite sure that, besides those whom I know to be interested in the subject, there are many others whose interest in the subject is not known to me, but who would be glad to take part in such a scheme. I doubt if, at the outset at least, any purely photographic papers should be included in the program, except such as might be directly

related to roentgenography, but I see no reason why either the Society as such or some of its members separately, but preferably with the specific encouragement of the Society, should not organize a photographic exhibit.

I am taking the liberty of suggesting that this letter be inserted in the Journal in order that those members to whom the idea may appeal may be induced to communicate with me to let me know of their interest in it. If a sufficient number should decide to cooperate, the idea can then be translated into tangible form.

A. U. Desjardins

Mayo Clinic,
Rochester, Minn.

NEW APPARATUS FOR THE PRODUCTION OF RADON

Addressing the Academy of Sciences, Professor d'Arsonval described a new apparatus that enables one to secure at once a continuous supply of radon, or emanation of radium, without the use of a solution of radium salts such as has been employed since the introduction of the Curie method, the application of which requires an extremely complicated apparatus. With the aid of his assistant Georges Vandon, Professor d'Arsonval has been doing research work on the subject, in his laboratory, since 1925. It required a long period of study, which was taken up by Vaugeois and, after his death, by Godin. It was a question of finding a stable source of radium emanation that could be substituted for the radium-bearing solution of Curie—a substance of small volume and not requiring any manipulation; a source adapting itself easily to a whole series of substances and thus making it possible to charge with radium emanation solids, liquids and many different gases, with a view to their application in therapeutics. The apparatus has now been completed. It is a simple metal tube containing a radium or a thorium salt, specially prepared in accordance with the formulas established by Vaugeois, which liberates, for a given time unit, at room temperature and without previous manipulation, the quantity of emanation for which it was constructed. The regularity and the constancy of the emission of the emanation, under these conditions, are maintained remarkably. The Vaugeois apparatus has the advantage of bringing a pure emanation, without any radium-bearing salt, in contact with the tissues. One avoids thus the destructive effects caused by the direct action of radium on the cells by reason of its long period of transformation and the difficulty of its elimination by the organism. This procedure makes radon treatment practical and eliminates all danger.—*J. Am. M. Ass.*, Sept. 24, 1932, *99*, 1095.

DEPARTMENT OF TECHNIQUE

Department Editor: ROBERT B. TAFT, 105 Rutledge Ave., Charleston, S. C.

AN IMPROVED STEREOSCOPIC MASTOID EXAMINATION

By THOMAS P. LOUGHERY, M.D., *and* WILLIAM R. STECHER, M.D.
Radiological Department, Germantown Hospital
PHILADELPHIA, PENNSYLVANIA

THE incentive for the development of the following device was the inherent inconvenience, time entailed, and an unsatisfactory method in viewing the four customary 8″×10″ stereoscopic mastoid films. The many advantages of the technique herein outlined will be presented, and the disadvantages of the current, almost universal technique of stereoscopic mastoid examinations will be discussed. In our opinion, these advantages are sufficient to warrant a trial and adoption of this method.

In the current technique, four cassettes are used, the intensifying screens of which are often of different speeds. This is frequently attributable to the difference in age of the screens, or in the event that the screens are of the same age, it often happens that one screen is used more than the others, thus altering the speed of the screen. Obviously, this is a non desideratum, inasmuch as the density of the films varies in the same examination.

Furthermore, we have the factor of expense to consider. Certainly small laboratories are unable to purchase a great number of cassettes and intensifying screens necessary for stereoscopic examinations. Moreover, in employing one 10″×12″ film instead of four 8″×10″ films, there is a saving of approximately 250 per cent of the total cost of the examination. This may be a further inducement for routine stereoscopic mastoid examinations, where heretofore the factor of additional expense had been prohibitive.

In the examination of mastoids in children, the speed of roentgenography is of paramount importance. The current method necessitates the carrying of four cassettes back and forth from the control room to the examining table, and in his haste it may happen that the technician is uncertain whether or not the cassette has been removed and a new cassette inserted. Thus, one image is superimposed upon the other, which renders the entire examination worthless. This cannot occur in the method herein advocated.

Again, the current technique involves the handling of four hangers, and in the developing of the films, particularly where the time-temperature method is not practiced, there occasionally results a marked difference in the density and contrast of the films. This apparently is due to the constant error in visual acuity of the technician, and occasionally can be ascribed to the mechanical difficulties encountered when the tank is crowded with films, preventing the expedient transfer of the films.

Since routinely all films are viewed wet prior to discharging the patient, we formerly had the additional inconvenience of viewing four wet films, whereas now merely one is scanned.

The diagnosis was handicapped inasmuch as one was unable to view both right and left mastoids in the stereoscopic boxes simultaneously. To be sure, one film can be balanced upon the other with painstaking patience, but the time required, as well as the insecurity of the mounts, is always undesirable. In the method advocated the finished film is merely cut in half and the respective halves are placed in the viewing boxes in perfect position.

The only additional equipment necessary, aside from a standard aluminum tunnel which accommodates a 10″×12″ cassette, is the device illustrated in Figure 1. The drawing is self-explanatory. It is distinctly advantageous for the opening of the tunnel to be at the one end rather than at the side, which permits of the use of an immobilizing band without interfering with the shifting of the cassette (Fig. 3).

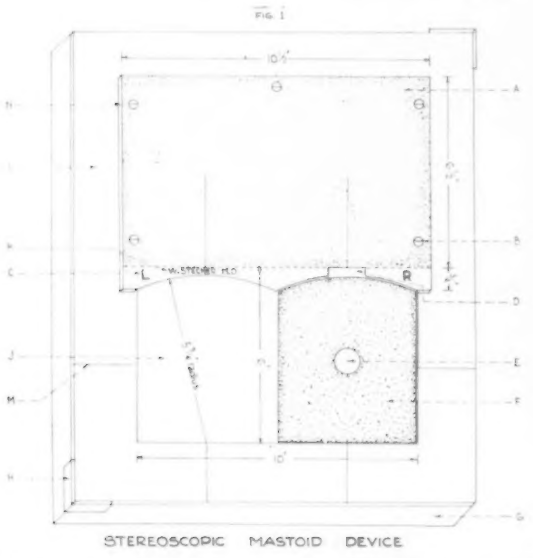


Fig. 1. *A*—Sheet lead 1/16″ in thickness, placed under wooden or aluminum top. *B*—Screw or bolt to fasten sheet lead and top in place together. *C*—Lead letters imbedded under wooden or aluminum top to facilitate in the identification of the respective sides in both mastoid and paranasal sinus examinations. *D*—Opening for film identification number, which is placed directly upon the cassette tunnel. *E*—Knob of lead blocker. *F*—Lead blocker constructed of 1/8″ thickness of lead. *G*—Cassette tunnel. Note:—Tray fits into upper end. *H*—Brass ledge, placed in opposite corners to hold mastoid device in position. These are fastened on the respective corners of the cassette tunnel or mastoid device. *J*—Aperture upon which patient's head is positioned, i.e., directly upon the top of the cassette tunnel. An immobilization band is employed. *K*—Lead film marker of roentgenologist or hospital, imbedded under top. *L*—Veneered wood or aluminum frame to exactly fit the cassette tunnel. *M*—Scribed lines to act as a guide for the proper centering of the object to be roentgenographed. *N*—Veneered wood or aluminum top to fasten sheet lead and identification numbers and name plate of roentgenologist in position.

Summary of Technique. 1. Place the identification number in the indentation provided for it. Place lead blocker in left opening. Place head in position for roentgenographing the right mastoid, in the opening at right side. Immobilize patient with head band. Insert cassette in tunnel. Tilt cone and position stereo-shift for first roentgenogram of right mastoid.

2. Remove cassette. After inverting, reinsert cassette in tunnel. Tilt cone in opposite direction and position stereo-shift for second roentgenogram of right mastoid.

3. Place lead blocker in right opening. Place head in position for roentgenogram of left mastoid, in the opening at left side. Immobilize patient with head band. Leave cassette, the tilt of cone, and position of stereo-shift as it was in 2. Focus over left mastoid and take first roentgenogram of left mastoid.

4. Remove cassette. After inverting, reinsert cassette in tunnel. Tilt cone in opposite direction and position stereo-shift as it was in 1. Take second roentgenogram of left mastoid.*

When the film is developed and dry, it is cut in half, each film being 6″×10″. The films are viewed in the stereoscopic boxes, using 10″ as the base when the mastoids have been roentgenographed with the stereo-shift transversely. This is well illustrated in Figure 2.

The following physical factors are employed:

Without Potter-Bucky Diaphragm, with Screens.†

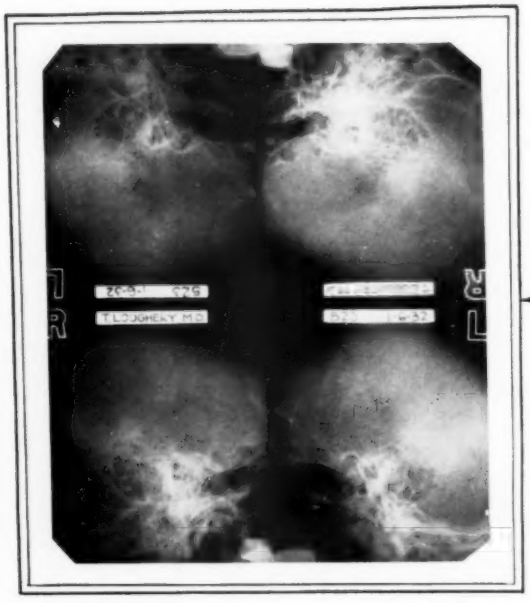
	Time	Dist.	Ma.	Kv.P.
Adult	5 sec.	25″	10	75*
	*½ sec.	30″	30	88
Child	⅕ sec.	25″	100	80*

A 3″×7″ cone should be used. * = variable.

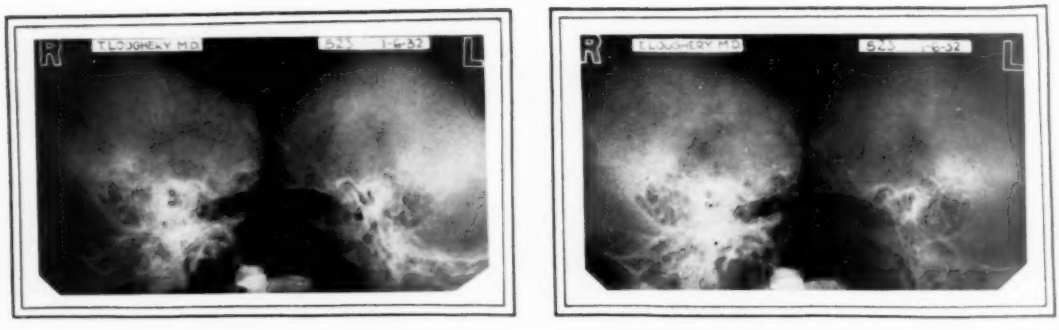
The device is applicable to any region of the body where bilateral stereoscopic views are advantageously taken, such as mandible, nasal accessory sinuses, etc. We also

* There is sufficient scattered radiation if not direct radiation to outline the number, so that an extra exposure is unnecessary with the openings blocked with the lead blockers.

† In a subsequent paper we intend to show how the principle of this method is adaptable with some slight modifications for the Potter-Bucky diaphragm technique.



Finished film as it is viewed "wet."



After the above film is dry, it is cut as illustrated and the resultant films are placed in stereoscopic viewing boxes.

FIG. 2.

Without Potter-Bucky Diaphragm	Time	Dist.	Ma.	Kv.P.
1. Nose-chin position. Centered at junction of nose and upper lip. No tube tilt.	2¼ sec.	25″	30	76*
	7 sec.	25″	10	76*
	5/10 sec.	30″	100	88*
2. Nose-forehead position. Centered at bridge of nose. Tilt tube 12° toward feet.	2¼ sec.	25″	30	72*
	7 sec.	25″	10	72*
	3/10 sec.	30″	100	88*
3. Open mouth-sphenoid position. Centered at open mouth. Tilt tube 24° toward feet.	2¼ sec.	25″	30	72*
	7 sec.	25″	10	72*
	2/10 sec.	30″	100	88*
4. Head, true lateral position. Centered at bridge of nose. No tube tilt.	2¼ sec.	25″	30	59*
	7 sec.	25″	10	59*
	1/10 sec.	30″	100	88*

A 3″×7″ cone is employed. * = variable.

employ the method in stereoscopic views of a wrist, etc., where special study is indicated, making a pair of anteroposterior views and a pair of lateral views. It can also be used to advantage in the routine four-view sinus technique. The technique employed is shown in the above tabular form.

Of course, the individual roentgenologist can improvise variations of the four-view sinus technique: as an example, one set of stereoscopic views in the Caldwell position, two other posteroanterior views of the sinuses, and a separate 8″×10″ film for the lateral view, made at a 6-foot distance. The stereo-shift in sinuses is lengthwise with the body, and this fact is taken into account in placing the cut film in the stereoscopic viewing boxes.

In conclusion, we have found it necessary for satisfactory stereoscopic examinations in very young and uncooperative children, to administer a light anesthesia, preferably with chloroform, and to complete the examination as speedily as possible, by having one person manipulate the cassette and signal the operator for the exposures. This plan has been most successful and excellent results have thereby been obtained.

One of us has experimentally found that there is sufficient film space for stereoscopic roentgenographic examination of mastoids on an 8″×10″ film. The dimensions of the device are correspondingly decreased, to accommodate an 8″×10″ cassette.

Fig. 3. The compression band and the opening of the aluminum tunnel toward the end of the roentgenographic table to permit of the expedient shifting of the cassette without disturbing the patient are shown above. Also, the various positions of the cassette are marked in the proper sequence as is outlined under Summary of Technique.

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

HEAD

HÄBLER, C. Die Heilungsvorgänge der Brüche des Schädeldaches im Röntgenbild. (The healing processes of fractures of the roof of the skull in the roentgenogram.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Sept., 1931, *44*, 352–359.

Illig recently made a detailed study of the duration of the roentgen visibility of cranial fractures in children. At about the same time the author, in association with Huber, started a study of his own cases and was able to collect 20 which were observed at periodic intervals during the past four years. The types of fractures represented were depression fractures, gaping linear fractures and fissures.

The following conclusions were reached: The depression fractures showed the best tendency to heal, they being in this respect similar to the fractures of the extremities, except that the process of union was more prolonged. Not infrequently a marked absorption of the depressed fragments with good repair of the bone was observed. In contradistinction to these, the gaping linear fractures remained visible in adults after three years or even longer, in spite of callus formation at the ends or borders of the fracture line. In children the defect likewise persisted for a rather long period, although the duration of healing was somewhat shorter than in adults. The fine fissures were demonstrable within one and a half years but within two and a half years or longer no trace was left of them. As a whole, the healing of all fractures of the skull was considerably prolonged above that of fractures of other parts of the skeleton.—*T. Leucutia.*

OSMOND, JOHN D. Accessory sinus infection in suspected pulmonary tuberculosis. *J. Am. M. Ass.*, Dec. 12, 1931, *97*, 1778–1781.

To be of greater service to the physician in the diagnosis of chest conditions, the roentgenologist should not rule out tuberculosis alone but should examine the paranasal sinuses for the origin of lung changes seen in chronic bronchitis, bronchial asthma or bronchiectasis. Of 124 patients having examination of both chest and sinuses, 76 had sinus disease and 17 both tuberculosis and sinusitis. Roentgenoscopy alone is insufficient for the diagnosis of early tuberculosis. Stereoscopic chest study is indicated whenever a known sinusitis exists. Pain is not necessarily a symptom of sinusitis and the patient may be unaware of the disease. Every child treated for enlarged glands following whooping cough should have the sinuses and chest studied preliminary to treatment. A careful history should prompt a roentgen examination of the sinuses in at least 9 per cent of chest cases examined.—*E. W. Hall.*

CASSOU, R. De la radiographie du canal optique. (Roentgenography of the optic canal.) *Bull. et mém. Soc. de radiol. méd. de France*, May, 1931, *19*, 225–229.

The tube is inclined 30° laterally and 15° cranially and the incidence of the central ray marked on the cassette. The patient is then placed in ventral decubitus with the forehead and nose on the cassette and the malar prominence of the side to be examined centered over the point of incidence of the central ray.

The optic foramen appears on the roentgenogram near the center of the orbital cavity. Normally, its form is circular, oval or triangular and its dimensions vary from 3.8 to 5.35 mm. in diameter.

Roentgenography of the optic canal should be performed in all cranial traumas in which an extension of the fracture line to the optic canal is suspected.—*T. Leucutia.*

BERTEL, GIUSEPPE. Morfologia e tecnica radiografica della "Fissura orbitalis inferior" e delle parti adiacenti. (Morphology and roentgen technique of the inferior orbital fissure and the adjacent parts.) *Radiol. med.*, Dec., 1931, *18*, 1541–1570.

The author first gives diagrammatic sketches illustrating the laws of projection and absorption in roentgenography of the skull in general and then takes up a discussion of the inferior orbital fissure and the roentgen technique to be used in photographing it. The inferior orbital fissure forms the boundary between the lateral and lower walls of the orbit and cannot be

shown in the ordinary anteroposterior projection with a central ray. It requires an oblique projection. The details of the technique for obtaining pictures of the region are described and illustrated with roentgenograms. The method is valuable in the diagnosis of diseases that are propagated through the inferior orbital fissure, whether they originate in the orbit and extend outward through it or are retro-orbital in origin and pass through the fissure into the orbit. They include inflammatory processes and cystic and malignant tumors.—*Audrey G. Morgan.*

Chaumet, G. La recherche des lésions de l'ethmoïde par la radiographie. (Demonstration of lesions of the ethmoid by roentgenography.) *J. de radiol. et d'électrol.*, July, 1931, *15*, 337–344.

Previously the author advocated two positions for roentgenography of the ethmoid bone, one anteroposterior (face down) and one vertical (with the film against the vertex, according to Hirtz). He has now changed this latter by placing the film underneath the chin (the so-called submaxillary incidence) and has obtained some very satisfactory results. Several roentgenograms illustrating various lesions in the two positions are reproduced.—*T. Leucutia.*

Maingot, Georges, Moret, François, and Sourice, André. Exploration radiologique du rocher. (Roentgen exploration of the petrous bone.) *J. de radiol. et d'électrol.*, July, 1931, *15*, 332–336.

The fundamental techniques of roentgenography of the petrous portion of the temporal bone may be summarized as follows: (A) simultaneous roentgenography of the two sides; (1) chin-vertex-plate incidence of Hirtz, and (2) occipital incidence of Worms and Breton. (B) Unilateral roentgenography with (1) occipito-zygomatic, (2) temporo-tympanic, and (3) fronto-tympanic incidences.

The authors have constructed an apparatus which permits the successive taking of roentgenograms of the right and left side for several of the above standard incidences without moving of the roentgen tube, the head being simply rotated (for an identical number of degrees) from the right to the left. The axis of rotation of the head coincides with the axis of rotation of the apparatus. The construction as well as the technique in the occipito-zygomatic, temporo-tympanic and fronto-tympanic positions is described in detail.—*T. Leucutia.*

NECK AND CHEST

Vallebona, Alessandro. Contributo allo studio del disegno polmonare. (Study of the lung design.) *Radiol. med.*, Nov., 1931, *18*, 1415–1439.

The author reviews the work that has previously been published on the subject of the anatomical substrate of the lung design and the shadow of the hilus. He thinks that the whole subject should be revised, taking into account the changes of interpretation necessitated by improved roentgen technique. He has done experimental work on the subject and reports his results, beautifully illustrated with roentgenograms.

He has studied the lung outline in man with the technique of micro-roentgenography, a technique which he devised. He also made experiments on animals in which he injected opaque substances into the heart, making it possible to demonstrate the blood vessel network of the lungs. With the aid of an apparatus which he constructed for the purpose he then studied the changes which take place in the lung outline in the different phases of heart action. He took several roentgenograms of the same region of the lung in the same period of apnea in different phases of the heart revolution and also studied the changes in the lung outline in different conditions of the lung (inspiration, expiration, atelectasis, pneumothorax, etc.).

He concludes that the lung outline is determined chiefly by the blood vessels of the lung. The walls of the bronchi and the non-aerated tissue of the lung in general may contribute to its formation. The air in the lungs is a contrast medium which serves to bring out the design. His work also shows that the details of the lung picture may be improved by special technical arrangements, and that there are changes in the design in the different phases of the heart's revolution, some of them due to the systole and diastole of the pulmonary arteries.—*Audrey G. Morgan.*

Iglauer, Samuel. Advantages of intubation method of introducing iodized oil for bronchography in children. *J. Am. M. Ass.*, Nov. 21, 1931, *97*, 1517–1521.

Bronchography should be more generally utilized in the diagnosis of chest conditions in

children, many chronic pulmonary diseases having their origin in childhood. Disease of the paranasal sinuses may lead to bronchiectasis.

Bronchography is contraindicated in the presence of high fever, dyspnea or recent hemoptysis, in cardiac decompensation and in cachexia.

The intubation method is simple and safe and can be used in children by any physician who masters the art of intubation. Combined with roentgenoscopy it affords a visual method of bronchography with the entire lung field under observation during injection. Confusing injection of alveoli can be minimized or avoided.

Various methods of bronchography are described; the intubation method, being the method of choice, is given in detail.—*E. W. Hall.*

MOSHER, HARRIS P. Fibrosis of the terminal portion of the esophagus: cardiospasm. *Proc. Internat. Assemb. Inter-State Post-Grad. M. Ass. N. Am.* (*1930*), 1931, *6*, 95–104.

So-called cardiospasm is usually due to fibrosis of peri-esophageal connective tissue in the crural ring and of the musculature of the esophagus. Anatomical studies in the new-born reveal much variation in development as well as changes due to disease. Many adults have no cardiac sphincter, the esophageal muscles ending above the cardia. The author has noted several cases of segmented musculature with thinned out layers of muscle and increased fibrous tissue. These areas are structurally weak.

Ulcer is the most rational starting point for cardiospasm, though many cases show no signs of such a lesion. Cardiospasm with pain is probably due to associated ulcer.

Hypertrophy of the crura and an unusual anatomical flexion are among the chief causes of cardiospasm. Spasm plays a small, if any, part. Stagnant food probably aids ulceration. Auerbach's plexus becomes involved in infection and fibrosis with resultant loss of muscular power.

The author's barium striped bag is of great value in diagnosis. It use reveals a slight constriction in the lower esophagus due to pressure from the crura, a sign diagnostic of so-called cardiospasm.

Treatment consists of dilatation under roentgenoscopic control in cases where muscle atrophy is not extreme and danger of perforation is not too great. In the latter cases gastrostomy or anastomosis between the esophagus and the stomach is necessary.—*E. W. Hall.*

ABDOMEN

MOREAU, LAURENT. Les ectopies thoraciques de l'estomac et de l'intestin. (Thoracic ectopies of the stomach and intestine.) *Bull. et mém. Soc. de radiol. méd. de France*, July, 1931, *19*, 348–351.

In a previous article (*Bull. et mém. Soc. de radiol. méd. de France*, March, 1927) the author published 2 cases of intrathoracic ectopy of the colon. In the present article he publishes a third.

The terminology "diaphragmatic eventration" which so often appears recently is unfortunate inasmuch as eventration implies a rupture of the wall and consequently a break in the continuity of a certain object. For this reason, it cannot be used for the designation of conditions due to a thinning or atony of the diaphragm and still less in congenital absence of the hemidiaphragm as in the three cases of the author.—*T. Leucutia.*

LAURELL, HUGO. Zur Frage der Entstehung kardianaher Magendivertikel und Zenkerscher Oesophagusdivertikel. Zugleich ein Beitrag zum Schluckmechanismus. (Origin of stomach diverticula near the cardia and Zenker's diverticulum of the esophagus, with a contribution to the mechanism of swallowing.) *Acta radiol.*, 1931, *12*, 455–478.

The author describes a case of transitory diverticulum of the stomach near the cardia, illustrated with roentgenograms, and discusses the causes which lead to the formation of diverticula at that site. The patients are generally middle-aged or older, and in 28 cases out of 34 they were women. In some cases the diverticula may be traumatic in origin. The author thinks they are generally pulsion diverticula and an important factor in their formation seems to be the negative intra-abdominal pressure which takes place in the upper part of the abdomen when the body is in an upright position. He thinks this negative pressure is greater in women with flabby abdominal walls than in men and this accounts for the greater frequency of this form of diverticulum in women.

He believes that Zenker's diverticulum of the esophagus is caused to a certain extent by the negative pressure back of the esophagus during a brief part of the period of deglutition when

the diverticulum begins to fill. He also discusses the buccopharyngeal phase of deglutition. The rapid passage of the food through the pharynx depends primarily on a combined mechanism of pressure and suction and secondarily on the peristalsis of the pharynx.—*Audrey G. Morgan.*

Sandera, Robert. Das Duodenum mobile im Röntgenbilde. (Duodenum mobile in the roentgenogram.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Nov., 1931, *44*, 574–599.

The article is divided into two parts. In the first general part the embryologic development of the duodenum and the possible form variations resulting from a faulty development are discussed in detail. The conclusion is reached that the normal duodenum owes its fixation primarily to the adhesion of the mesoduodena dorsalia to the peritoneum dorsale and in the second instance to the adherence of the pancreas, of the fascia renalis of the right kidney, of the base of the mesenterium and of the mesocolon transversum.

In the second special part, the various types of malformations resulting from poor fixation are discussed on the basis of several case reports. The duodenum mobile is defined as a congenital dystopy produced by complete or partial lack of adherence of the mesoduodena dorsalia, the duodenum itself having developed normally from the two upper loops of the embryonal gut. Poor fixation of the adjacent organs (pancreas, right kidney, mesentery and mesocolon) may also play a certain role. The dystopies of the right kidney (congenital malformations, horse-shoe, polycystic and migrating kidneys) are in this respect of special importance.

The roentgenologic picture of duodenum mobile is not entirely clear. In most cases it is very difficult, if not impossible, to demonstrate the direct or indirect congenital cause. In others, the condition may have all the semblances of an acquired dystopy; finally, in a third group, a combination of the two, that is, an acquired dystopy on a congenital basis, may be demonstrated. The author believes that two forms have a rather typical roentgen appearance: the so-called duodenum mobile totale and the duodenum inversum. Several case reports are used in discussing this appearance. In a third division cases with partial fixation, the so-called duodenum partim mobile, are placed.

The clinical picture is likewise indefinite. The attacks of colic which were considered as typical by Miyakes represent only a single symptom; other manifestations which may occur rather frequently are: the collateral gastritis from the stasis of the chyme in the stomach and duodenum, ulcerative processes from disturbed duodenal passage or irritation of the pancreas, peripancreatitis and periduodenitis from infrapapillary stenosis, etc. Often, the secondary changes of the neighboring organs are of greater clinical importance than the primary duodenum mobile itself.—*T. Leucutia.*

Colanéri, L.-Jh. Spasmes caecaux, retard iléal et appendicite chronique. (Cecal spasms, ileal stasis and chronic appendicitis.) *Bull. et mém. Soc. de radiol. méd. de France*, May, 1931, *19*, 218–224.

Jacquet and Gally in a recent article considered the following three signs as typical of the chronic appendicial syndrome: (1) ileocecal stasis; (2) ileocecal spasms, and (3) localization of point of tenderness. In making a critical analysis of these three signs on the basis of his own experience, the author expresses the opinion that the visualization of ileocecal stasis and of ileocecal spasms is of very limited value and that the demonstration of the classical point of tenderness is the only positive sign which can be advantageously used in making a roentgen diagnosis of chronic appendicitis.—*T. Leucutia.*

Lovisatti, Nicola. Über Form, Grösse und Lage des Zökums. (On the form, size and position of the cecum.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Aug., 1931, *44*, 181–188.

The author distinguishes three main types of the cecum: (1) the funnel-shaped or fetal type; (2) the ampulla type with the appendix in the midportion, and (3) the ampulla type with over-development of the anterolateral wall, the appendix being medially upwards and slightly backwards. If one includes the two possible variations (the vase-like and cylindrical) of the appendix, the following five subdivisions may be made: (1) funnel shaped or fetal cecum; (2) ampulla-shaped cecum with vase-like appendix attached to the midportion of the cecum; (3) ampulla-shaped cecum with cylindrical appendix attached to the midportion of the cecum; (4) ampulla-shaped cecum with vase-like appendix attached medially upwards and backwards, and (5) ampulla-shaped cecum with cylindrical appendix attached medially up-

wards and backwards. Type four occurs most frequently and is often associated with inflammatory phenomena of the appendix. It is the author's contention that the funnel form is the result of a pull of the arteria appendicularis on the appendix on one side and of the distention of the anterior lateral cecal wall by the weight of the food on the other. The author also describes the changes in size of the cecum (the rudimentary cecum and the macrocecum) as well as the possible variations in position.—*T. Leucutia.*

RANKIN, FRED W. The surgical treatment of carcinoma of the colon. *Surg., Gynec. & Obst.*, Aug., 1931, *53*, 229–238.

Ten per cent of all carcinomata which occur in the gastrointestinal tract are in the large intestine or rectum. A large majority of carcinomata of the colon develop on polyps. In tracing 13 cases of polyps observed at the Mayo Clinic, the author, with Fitzgibbon, recently found carcinomatous changes to have occurred in all but 2 cases. This work confirmed similar previous observations by Hauser, Wechselmann and Schneider. Polyposis or adenomatosis then must be regarded as a percursor of cancer.

Symptoms:—The most important early evidences of carcinoma in any portion of the colon are changes in intestinal habit, as evidenced either by irritability, mucous diarrhea, or alternating periods of diarrhea and constipation; localized pain and tenderness without a tendency to disappear; tumefaction, and profound anemia not accompanied by loss of blood, or, if the lesion is in the left half of the colon; obstruction of the acute, subacute or chronic variety. Moynihan's axiom is strikingly true; it reads as follows: "In left colonic growths, constipation is the rule, while in right colonic growths, constipation is rare." This may be supplemented by the aphorism of Rutherford Morrison: "Increasing constipation of recent origin in an elderly person, only overcome by purgatives, suggests malignant disease of the left half of the bowel." In the presence of these suggestive phenomena, it is imperative that a complete gastrointestinal examination at the hands of an experienced and competent roentgenologist be undertaken. In 102 cases of carcinoma of the colon beyond the transverse segment, proved at operation in 1929 at the Mayo Clinic, error in diagnosis roentgenologically was made in only 3 cases. The advancement of roentgenologic technique to the present point of accuracy is of greatest importance in the diagnosis of colonic malignancy.

The author strongly emphasizes the fact that the loss of weight, cachexia, dehydration, and desiccation so frequently referred to as diagnostic phenomena of carcinoma of the colon, are in reality not symptoms of carcinoma at all but are signs of metastasis and impending dissolution.

The operative technique is discussed and particular stress is placed upon the adequate preoperative rehabilitation of the patient before attempting surgical procedures; employment of intraperitoneal vaccination with colon bacilli and streptococci in an effort to immunize against peritonitis, and upon selection of an operation for the patient rather than attempting to standardize maneuvers to fit all cases of organic lesions to one or two types of procedure.

The operability at the Mayo Clinic in 1929 was 57.5 per cent. The author favors operating on all cases in which any hope of cure can be entertained, making the operability of the carcinoma the deciding factor rather than the immediate mortality rate. Their immediate operative mortality was 8.7 per cent in 160 cases in which operation was performed for lesions occurring in the large bowel proximal to the middle of the transverse colon, and 7.4 per cent in 227 cases in which operation was performed for lesions distal to this point. The author concludes by saying that the improvement in diagnostic methods, particularly in roentgenoscopy and proctoscopy, permitting earlier recognition of lesions of the large bowel and rectum, together with emphasis on the importance of more routine examinations, particularly after the development of the earlier symptoms of intestinal dyscrasias, or as a part of the routine yearly examination, will bring this group to examination and operation at an earlier time. These measures will undoubtedly increase the operable group to more favorable proportions and, at the same time, will offer much more reasonable hope for a satisfactory end-result.—*J. H. Vastine.*

MOORE, A. B., and MERRITT, E. A. Roentgenologic diagnosis of appendicitis. *J. Am. M. Ass.*, Nov. 14, 1931, *97*, 1456–1457.

The roentgenologic diagnosis of appendicitis has not received the consideration it merits and standard roentgenologic signs are needed in diagnosis. The signs are best elicited about

eighteen hours after a barium meal or, occasionally, by opaque enema when the meal is contraindicated. Over 80 per cent of appendices were visualized in the authors' series.

Roentgenologic signs of appendicitis are: tenderness and muscular rigidity, fixation of the appendix, pain referred to the appendix when other parts of the abdomen are palpated, spasticity of the cecum, and pain referred to other parts of the abdomen by pressure over the appendix. Abnormal position of the appendix with localized tenderness is a very important finding which may be of life-saving value. —*E. W. Hall.*

Morton, Charles B., and Archer, Vincent W. Ascariasis; some surgical and roentgenologic aspects. *J. Am. M. Ass.*, Feb. 6, 1932, *98*, 473–476.

Several cases have been encountered in which intestinal ascariasis has simulated acute surgical diseases of the abdomen, notably appendicitis. Two cases of frank intestinal obstruction and one of ascariasis of the gallbladder were found in a series of 110 patients with ascariasis. Sixty-nine of the series had no characteristic symptoms and the ova or parasites were found incidentally. Of the remaining forty-one, 24 had symptoms of appendicitis or intestinal obstruction and 5 simulated gallbladder disease.

The routine barium meal examination with films at one, two and four hours after ingestion shows cylindrical filling defects due to ascarids and later small string-like shadows are seen due to material in the enteric canal of the parasites.

Ascariasis should be considered in the differential diagnosis in cases with atypical intestinal symptoms.—*E. W. Hall.*

Grynkraut, B. De la cholécystographie physiologique. (Physiological cholecystography.) *Bull. et mém. Soc. de radiol. méd. de France*, May, 1931, *19*, 243–245.

The author advises the administration of cholagogues such as bile, diluted hydrochloric acid (3 per 1000) or secretine for the speeding up of cholecystography. The bile seems to have the best effect. The procedure is as follows: The gallbladder dye is administered orally in the routine fashion. Then one or two keratinized capsules of beef bile are given every hour for a period of six hours, when the first roentgenogram is taken. Due to the accelerating effect of the cholagogue the roentgen examination is completed within three hours. It is advisable to administer in well-selected instances antispasmodics (papaverin) to rule out negative cholecystograms on a reflectoric basis (for example, in duodenal ulcer or less frequently in carcinoma of the stomach, ureteral calculi, etc.).

By following the above method, the author was able to obtain a filling of the gallbladder in several instances in which the routine cholecystographic examination led to non-filling.—*T. Leucutia.*

Chiray, M., Lesage, J., and Taschner, E. L'élimination hépatique de la tétraiodophenolphtaléine et ses rapports avec la cholécystographie. (The hepatic elimination of tetraiodophenolphthalein and its relation to cholecystography.) *Presse méd.*, Nov. 4, 1931, *39*, 1605–1608.

Delrez and Paris in a recent article (see abstract this Journal, August, 1931, *26*, 307–308) published the results of their experimental investigations on the rhythm of the hepatic elimination of tetraiodophenolphthalein and its effect on cholecystography. They collected the bile through a surgical fistula after performing a cholecystotomy or choledocotomy. The authors repeated the experiments, however, by collecting the bile through duodenal tubing. The series included 25 cases, a total of over 70 duodenal tubings having been made. Only healthy individuals or patients suffering from a mild vagosympathetic disequilibrium or cholecystatony were chosen for examination. The technique consisted in the administration of 3.20 grams of tetraiodophenolphthalein per os following a preliminary preparation with sedatives over a period of several days to combat possible digestive spasms. The tubing was practiced in the routine manner. After collecting bile A, the gallbladder was emptied by means of the classic Meltzer-Lyon procedure of bile B and then bile C (direct hepatic) was used for dosage. The iodine content of the bile was determined according to the Chiray-Cuny procedure, this being described in detail.

It was found that the elimination of the iodine through the liver commences very soon (three hours) after the ingestion of the drug, it reaches its maximum between the tenth and thirteenth hours and then gradually decreases, continuing occasionally as long as four to eight days. A second important finding was the poly-

cyclic nature of the elimination with peaks at the three to four, eight to nine, ten to thirteen, and eighteen to twenty-four hour periods. In a general way, these findings coincide with those of Delrez and Paris.

The authors have also endeavored to determine the elimination curve in pathologic cases but the individual variations in the healthy and especially the polycyclic variations were so great, that no standard curve could be established for the purpose of comparison. The problem was still further complicated by the exceedingly difficult practical application of the duodenal tubing. It is possible that with the introduction of stimulants of the hepatic function, a more rapid elimination of the iodine and thus a more standard curve can be obtained. The study of this will form the subject of future investigations.—*T. Leucutia.*

LEB, A. Experimenteller Beitrag zum cholezystographischen Füllungsausfall der Gallenblase bei Ulcus duodeni. (Experimental contribution to the cholecystographic non-filling of the gallbladder in duodenal ulcer.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, July, 1931, *44*, 16–27.

The author in 1927, in cooperation with Orator, called attention to the fact that a cholecystographic non-filling of the gallbladder occurs in a great number of cases of duodenal ulcer. It was recommended at that time that in all instances of non-filling of the gallbladder an additional examination of the stomach and duodenum be made to rule out the possibility of duodenal ulcer. This procedure has since then been used in a routine fashion and the author now wishes to give some additional information on the subject. (1) The intravenous cholecystography in 100 patients with duodenal ulcer led to a non-filling of the organically healthy gallbladder in 26 per cent of the cases. In 25 which came to operation (the percentage of non-filling in these cases being 40) the roentgen findings were confirmed. Of the remaining cases with positive filling of the gallbladder many showed signs of dyskinesia, the egg yolk meal leading to accelerated or retarded evacuation. One may assume that this behavior of the gallbladder in duodenal ulcer is the result of nervous irritative processes. (2) A series of experiments carried out in dogs showed that adhesive peritoneal irritations in the duodenal and gallbladder region considerably influenced the rate of evacuation of the gallbladder, often leading to stasis. Such a process likewise produced a block of the cholekinetic food stimulus leading from the duodenum to the gallbladder. (3) Another series of experiments on anatomic specimens of the gall ducts revealed that in case of stasis the passage of the contrast solution through the gallbladder was considerably prolonged, no doubt as a result of the reduced capacity from the pre-existing stasis.—*T. Leucutia.*

BERMOND, MARCO. Un nuovo segno colecistografico della calcolosi biliare. Il segno del "menisco." (A new cholecystographic sign of bile calculus—the meniscus sign.) *Radiol. med.*, Nov., 1931, *18*, 1450–1456.

A case is described in a woman of thirty-five in which the author saw a new cholecystographic sign which he calls the meniscus sign because of the concave appearance of the upper level of the tetraiodized bile. The diagnosis of gallstone which he made from this sign was confirmed on autopsy. He interpreted it as being caused by a solitary calculus which, as it was lighter than the tetraiodized bile, floated on its surface and made an imprint on it.

In this patient the gallbladder filled readily and satisfactorily through the cystic duct but it was very slow in emptying through the cystic duct, which was permeable and there was no atony of the gallbladder. The author explains this by assuming that the stone acted as a valve. It was located near the neck of the bladder and allowed the bile to enter when the bladder was relaxed, but when the bladder contracted the stone was pushed against the opening of the duct and prevented the bile from emptying. A diagrammatic sketch of this action is given.—*Audrey G. Morgan.*

GENITOURINARY SYSTEM

KRETSCHMER, HERMAN L. Diseases of the urinary tract in infancy and childhood. *Surg., Gynec. & Obst.*, Aug., 1931, *53*, 129–154.

Tumors of the Kidney. These are rare in children. Hinman and Kutzman found only 14 cases of renal tumors in 20,470 autopsies on children, a percentage of 0.07. Tumors of the renal parenchyma are the most frequent. There is still some confusion regarding the nomenclature. The most common type, however, is generally recognized as the so-called *mixed tumor of Wilms.* These are occasionally bilateral. Both epithelial and connective tissue are pres-

ent. Symptoms are fever, abdominal pain, loss of appetite and weight, irritability and abdominal enlargement. Hematuria is rare. Plain roentgenograms will often reveal the outline and extent of the tumor. Intravenous pyelography is very valuable in helping to establish a diagnosis. Extension may take place throughout the entire abdomen and through the diaphragms. Metastasis occurs to the liver and lungs. The rate of growth is usually rapid and the termination is fatal.

Tuberculosis of the Kidney. This is rare in children. Kustu, in a series of 335 cases of renal tuberculosis (operated upon), reports that only 3 per cent of the cases were children under ten years of age.

Cases of pyuria or hematuria and cases with persistent bladder symptoms which fail to respond to medical treatment should be examined with the possibility of renal tuberculosis in mind. Routine roentgen examination of the urinary tract will often show areas of calcification compatible with renal tuberculosis. When known to be tuberculosis, the involved kidney should be removed. The problem is to determine which kidney is involved and the functional capacity of the well side. Intravenous pyelography gives valuable information in determining this.

Urinary Calculi. In children the stone is found in the bladder in the great majority of cases. Bokay found the stone in the bladder in 1,150 out of 1,621 cases of urinary calculi in children. In regard to the incidence of lithiasis in children, Hager, in a series of 32,995 cases of children under fifteen years of age found bladder stones in 1.63 per cent, ureteral stones in 0.86 per cent and kidney stones in 0.83 per cent. Gastrointestinal symptoms are often dominant and hence the urinary condition is overlooked. The usual symptoms are pain, hematuria and pyuria. Bladder stones also produce frequency, urgency and tenesmus. The case is often erroneously diagnosed enuresis. The author recommends routine roentgen examination of cases of enuresis to exclude calculi.

Infections of the Kidney. Chronic infections which fail to respond to treatment should be thoroughly studied to exclude calculus or obstruction. Pyelograms are invaluable in showing the site of obstruction.

Congenital Anomalies. These are comparatively frequent. Bilger, in 153 consecutive necropsies on children, found anomalies of the urinary tract in 13 per cent. Bugbee and Wollstein found anomalies in 2.3 per cent of 4,903 autopsies. Lowsley and Butterfield, in a series of 100 urological conditions in children found 29 instances of congenital anomalies, 13 of which were of such a nature that they probably influenced an infection of these organs. Beer and Hyman, in reporting a series of 150 urological conditions in children, found one-third due to anomalies. Mertz, in 49 cases of chronic pyuria in infancy and children, found congenital changes in 40 per cent.

The value of urograms in diagnosing these anomalies is evident.

Spina Bifida. This is a frequent cause of incontinence. All cases of enuresis should be examined with the possibility of spina bifida as an etiologic factor in mind. Mertz and Smith have made a careful review of the literature upon this subject.

Obstruction to the Outflow of Urine. Fibrosis at vesical neck. Usually occurs in males. The symptoms are dysuria, small stream, incontinence, suprapubic fullness. They are often treated for enuresis. Intravenous urography is of great value in demonstrating the degree of distention of the urinary tract and the site of obstruction.

Hypertrophy of the verumontanum may produce a very marked obstruction to the outflow of urine. This subject has been reported upon by Bugbee and Wollstein, and by Robinson.

Congenital valves of the posterior urethra are relatively rarely found in children. If present they are seldom recognized until great damage has been done to the upper urinary tract because of mechanical obstruction. If proper diagnostic procedures are instituted, the condition should be recognized early instead of late, proper treatment can be instituted and much renal damage thus prevented. There had been 70 cases of congenital valves of the urethra reported in the literature up to 1931.

Diverticulum of the bladder in children is generally associated with obstruction at the neck of the bladder. They can be easily demonstrated by cystograms. Diverticula occur with predilection in the region of the ureteral orifices.—*J. H. Vastine.*

Wolke, Knut. Some experiments in rectal pyelography. *Acta radiol.*, 1931, *12*, 497–515.

The author describes the technique used for rectal pyelography. The patient is prepared as for an ordinary kidney examination and not

allowed to drink for twelve hours before the examination. Two hours after he has been given an enema, an ordinary roentgen examination of the kidneys is made, after which four suppositories, each containing 5 grams of abrodil, are introduced into the rectum. Forty-five minutes later a survey film is taken and fifteen minutes later another survey film. One hour and fifteen minutes after the abrodil has been introduced into the rectum, compression is made over the ureters with a compression ball. Pyelograms are then taken about every ten minutes for an hour if that long a period of compression is necessary. If there has been no filling by this time the abrodil is flushed out.

The indications for rectal pyelography are in general the same as those for intravenous pyelography, namely, in cases in which catheterization of the ureters is impossible, in advanced bladder disease and in hypersensitive patients, in children and in patients in poor general condition. There are special indications for rectal pyelography in cases in which it is not possible to puncture a vein and in cases in which intravenous pyelography is contraindicated, such as thyrotoxicoses, pronounced renal insufficiency and advanced tuberculosis. In rectal pyelography the blood is not flooded with contrast medium to the same extent as in intravenous injection. It is useful in polyclinic examinations on account of the simplicity of the method and in cases in which the patient refuses intravenous injection.

Thirty-seven cases in which the method was used are discussed and profusely illustrated with roentgenograms. A number of illustrative cases are described in detail. Successful roentgenograms were obtained in 90 per cent of the cases and this figure could doubtless be increased with practice.—*Audrey G. Morgan.*

SKELETAL SYSTEM

MÜLLER, WALTHER. Spaltbildungen an Gelenk- und Dornfortsätzen der Wirbelsäule auf der Basis von Umbauzonen. (Gap formations in articular and spinous processes of the vertebral column on the basis of transformation zones.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Nov., 1931, *44*, 644–648.

The author observed a gap formation in the transverse process of one of the lumbar vertebrae in one case and of the spinous processes of the sixth and seventh cervical vertebrae in two other cases. In studying the origin of these formations he found a specimen in the bone collection of the Königsberg Surgical Clinic which showed similar gap formations in the spinous processes of two vertebrae involved in a gibbus. It was concluded that the mechanical pull on the spinous processes resulted in absorptive bony changes with gap formation. Thus the condition represents a "transformation process."—*T. Leucutia.*

PÉLISSIER, G. Radiographie de face de la colonne cervicale dans son ensemble. Technique nouvelle. (Frontal roentgenography of the cervical spine in its entirety; new technique.) *Bull. et mém. Soc. de radiol. méd. de France*, July, 1931, *19*, 360–361.

In order to obtain a roentgenogram of the entire cervical spine in the anteroposterior view the patient is placed in dorsal decubitus, the head immobilized in slight flexion and the tube centered over the superior dental arch. During the taking of the roentgenogram, which is made with a current of small intensity so that the exposure may last longer, the patient slowly moves his jaw up and down. The roentgenogram, although not entirely satisfactory from the point of view of quality, is sufficient to give a general view. For greater detail the usual technique is used.—*T. Leucutia.*

MEYER-BORSTEL, H. Die verschiedenen Assimilationsformen des 5. Lendenwirbels im Röntgenbild und die pathogenetische Bedeutung der einseitig-gelenkigen Sakralisation. (The various assimilation forms of the fifth lumbar vertebra in the roentgenogram and the pathogenetic significance of the unilateral articular sacralization.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Sept., 1931, *44*, 363–375.

There is great confusion concerning the significance of the different anomalous forms of the fifth lumbar vertebra. The statistics dealing with sacralization give a percentage which varies from 1.7 to 60, expressing the uncertainty which exists. The author advises the following classification: (1) Unilateral or bilateral incomplete sacralization (when there is enlargement of the lower portion of the transverse process, however without articular contact of the sacrum, that is without neoarthrosis); (2) bilateral bony sacralization (when both transverse processes are united with the sacrum); (3) bilateral articular sacralization (when both transverse processes form an articulation with

the sacrum); (4) bony sacralization on one side and articular sacralization on the other; (5) unilateral bony sacralization (the other side being normal); (6) unilateral articular sacralization (the other side being normal). In studying the clinical symptomatology in the above groups the author found that there is great variation. Only 2 cases were observed of group 1, but in groups 2 and 4 it was found that there was no relation between the sacralization and the sacral pain. In group 3 five cases out of eleven presented clinical symptoms showing that some relation must exist. In group 5 clinical symptomatology was demonstrated only in the cases associated with scoliosis. In group 6, there was a very definite relation between pain and roentgen findings. Of a total of 23 cases observed only one case was free of symptoms. It must be mentioned, however, that advanced osteoarthritic changes were associated nearly always, even in the young, with the sacralization and that the disturbed static of the spinal column led to an oblique position of the sacralized vertebra with secondary scoliosis. There can be no doubt that these changes were responsible for the pain.—*T. Leucutia.*

Hirsch, R. Zur Frage der Sakralisation. (On the question of sacralization.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Aug., 1931, *44*, 215–226.

After a brief discussion of the definition, etiology, clinical symptomatology, anatomy, therapy and roentgen appearance of sacralization, the author gives a tabular arrangement of all cases which he has observed during the past five years in a total of 1000 examinations. The following is the statistical compilation: (1) Total number of sacralizations (uni- and bilateral)—1.3 per cent; (2) butterfly and other forms (uni- and bilateral)—11.3 per cent; (3) small transverse processes (uni- and bilateral)—2.4 per cent; (4) lumbarizations (uni- and bilateral)—2.4 per cent, this giving a total of 17.4 per cent.

In a further analysis of the problem, the author reviews the case reports (14 of which are briefly summarized). He found that the above anomalies produce no typical clinical picture. The same symptoms are observed, for example, in sacralization and in the butterfly types as in the small transverse processes of the fifth lumbar. For this reason, the therapy should consist in the conservative treatment of the manifest symptoms without resorting to the much-advocated surgical interventions.—*T. Leucutia.*

Safta, Emil. Despre spina bifida occulta si asociatia sa cu câteva malformatiuni osoase si osteoarticulare. (Spina bifida occulta and its association with some osseous and osteoarticular malformations.) *Cluj. med.*, 1931, *12*, 538–546.

A series of 28 cases of spina bifida occulta was observed at the Surgical Clinic of the University of Cluj. In the majority of these the condition was associated with nervous disorders (peripheral paresis), sphincteric disturbances (nocturia), trophic changes (muscular atrophy, plantar sores, etc.) and osseous or osteoarticular malformations (scoliosis, luxation of the hip, pes varus, valgus or equinus, deformities of the toes, etc.).

In studying the osseous and osteoarticular malformations, the author found that they may be classified into three groups: (1) those which are simply accidental (as, for example, the luxation of the hip or less frequently the numerical or morphological variations of the vertebrae); (2) those which are the result of the spina bifida occulta itself (as, for example, the myelodysplastic or neurodystrophic disturbances), and (3) those which are secondary to the changes brought about by the spina bifida occulta (as, for example, the mechanostatic scoliosis). Routine roentgenograms of the pelvis made in 13 cases also revealed the presence of coxa valga in every instance, indicating that a close association between this and spina bifida occulta must exist.

It was observed that operative procedures, although leading to some very encouraging results in the nocturia, failed to influence the osseous or osteoarticular malformations. From the point of view of clinical symptomatology, the deformities occupied an intermediary nosographic position between those of nervous and congenital origin.—*T. Leucutia.*

Mouchet, Albert, and Nadal, René. Entorse vertébrale lombaire. (Lumbar vertebral sprain.) *J. de radiol. et d'électrol.*, Oct., 1931, *15*, 565–566.

This is a brief report of a case of lumbar sprain following brusque trauma, which on roentgen examination showed small triangular bone splinters, at the upper right borders of the second and third lumbar vertebrae. It is most probable that the splinters represented de-

tached bony fragments of the vertebral bodies due to violent muscular contraction.—*T. Leucutia.*

HAMMERBECK, W. Pseudozysten im Röntgenbild der Wirbelsäule. (Pseudocysts in the roentgenogram of the spinal column.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Sept., *1931*, *44*, 359–362.

Multiple cysts of the vertebral bodies were observed in a specimen from the bone collection of Schmorl. The findings are described in detail. The opinion is expressed that the cystic areas were the results of several factors such as bone absorption in the midportion of the vertebral body, marked osteophytic changes at the borders, and generalized osteoporosis. It is interesting that the cysts were localized to the kyphotic portion of the spine only. No similar cases were found in the literature.—*T. Leucutia.*

GIRAUDI, GIOFFREDO. L'artrosi deformante unco-vertebrale. (Unco-vertebral arthrosis deformans.) *Radiol. med.*, Nov., 1931, *18*, 1457–1474.

The author thinks that Virchow's arthritis deformans should be called arthrosis deformans, as there is no true inflammation. He describes this affection in the unco-vertebral joints or Luschka's lateral intervertebral hemiarthroses. On the lateral edges of the cervical vertebrae there are two small vertical eminences which the Italians call uncini or hooks and the French call semilunar processes. A ligament called Trolard's unco-vertebral ligament extends from the lateral margin of the upper joint surface to the corresponding margin of the semilunar process. Luschka calls these hemiarthroses or half-joints, because they are intermediate between synarthroses and diarthroses. Little attention has been given to pathological processes in these joints. Arthrosis deformans of these joints is generally only a part of an involvement of all the cervical articulations. In the roentgen picture of advanced forms of this disease there is a remarkable reduction in the thickness of the joint interline which becomes almost horizontal, and deformity of the joint surfaces with pads on the edges which project laterally. The author says this picture is pathognomonic.

Quite often the arthrosis shows practically no clinical symptoms. In other cases, however, it is associated with pain and decreased motility and symptoms due to pressure of the pads on the nerves in the spaces between the transverse processes and in the intervertebral foramina. The symptoms may be due to involvement of the anterior branches of the cervical nerves, or a posterior cervical sympathetic syndrome due to a lesion of the vertebral nerve. Two typical cases of the disease are reported.—*Audrey G. Morgan.*

PERUSSIA, FELICE. Il riconoscimento radiologico precoce delle metastasi neoplastiche dello scheletro. (Early roentgen recognition of tumor metastases in the bones.) *Radiol. med.*, Nov., 1931, *18*, 1399–1415.

Sometimes bone metastases are the first signs of a primary tumor that has remained latent. This is particularly true of tumors of the thyroid, prostate and suprarenals. It is therefore particularly important to demonstrate them by roentgen examination and the author advises making systematic roentgen examinations of the whole skeleton when there is pain of unknown origin in the pelvis or spinal column, or in any progressive disease with a slow course showing anemia or cachexia.

There are no pathognomonic signs of bone metastases. In quite advanced cases of the osteolytic form there may be an osteoporotic worm-eaten appearance, erosion or irregularity of the trabecular outline, disappearance of all bone structure or even totally transparent places looking as if a part of the bone had been resected. In the osteoplastic form there may be massive eburnation or small disseminated zones of increased density. There is a mixed type with a picture resembling that of Paget's disease. Diagnosis is very difficult in early cases, particularly in the ribs and bones of the pelvis and spinal column which are the sites of predilection for bone metastases. In the pelvis the characteristic spotted appearance of bone metastasis may be simulated by superposition of the intestine filled with gas or a mixture of gas and feces. However the spotted area is apt to extend beyond the bone if it is caused by intestine, and the dense shadows of the crests of the bones are unaffected, while they are very apt to be affected by metastases. In the ribs a similar picture may be created by superposition of the lung outline. Bone metastasis in the spinal column often simulated spondylitis deformans, as both diseases show flattening and deformity of the bodies of the vertebrae with marginal beaks, decalcification, etc. Such a picture in a patient with a history of tumor

suggests metastasis. In metastasis there are never the true osteophytes that are seen in spondylitis deformans as the changes are rarely productive.

In doubtful cases a systematic study should be made of the whole skeleton, particularly with series of roentgenograms, the later ones of which often show accentuation of signs that were at first slight or even unnoticed.

The author's observations are based on a large number of cases seen at the Cancer Institute of Milan.—*Audrey G. Morgan.*

GESCHICKTER, CHARLES F. So-called fibrosarcoma of bone; bone involvement by sarcoma of the neighboring soft parts. *Arch. Surg.*, Feb., 1932, *24*, 231–291.

In this presentation the author has attempted to establish the true nature of the so-called fibrosarcoma of bone. The study is based upon a series of 50 cases clinically grouped under the heading of fibrosarcoma of bone.

The osteogenic portions of the bone do not give rise to sarcoma of the true fibrospindle cell type. Fibrospindle cell sarcoma arising in either the outer layers of the periosteum or in the adjacent soft parts may, however, invade the osseous substance and give rise to a tumor in which the predominant manifestations on physical or roentgenologic examination are related to the bone. The cases studied fell into three general groups: the first and largest had their origin either from the fibrous portions of the outer periosteum, the fascia or the fibrous portion of nerve trunks or vessels, and constituted the fibrospindle cell series; the second group arose from the neurogenic elements of the soft parts, and the third constituted a miscellaneous group derived from other soft part structures. The present study is to show that the histologic composition in the new growth is a more reliable index to its clinical and pathologic behavior than is the anatomic location or apparent relationship to bone.

Tumors of the Fibrospindle Cell Group. Invasion of the bone from without, through direct extension by a tumor of non-osseous origin usually indicates the presence of a sarcoma of the fibrospindle cell group. The majority of these are not of a high degree of malignancy.

Clinical Features:—Fibrospindle cell sarcoma occurs most frequently beyond the age of thirty. The lower extremity is usually the site of predilection, the region of the femur being most often involved. The history is of about one year's duration beginning with pain of increasing severity and followed by the appearance of swelling and then by dysfunction of the limb. When the swelling is situated near the end of a bone, the growth may extend across the joint and ultimately involve a neighboring bone, a type of invasion that is exceedingly rare in osteogenic tumors. Metastases to the lymph glands has not been proved in these cases and probably does not occur.

Roentgenologic Features:—This tumor occurs as a single lesion frequently near the lower end of the femur or the upper end of the tibia. One of its most characteristic features is the production of a large soft tissue shadow. It tends to destroy the bone from without. The bone is melted away with little or no periosteal reaction. Calcification in the tumor shadow is not the rule. Usually the extra-osseous shadow is large before much evidence of bone involvement is found.

Gross Specimens:—The tumor is generally encapsulated although it may invade the muscle. It is firm and fibrous in consistency. In the more rapidly growing neoplasms the mass may be fleshy. Dissection of the mass at operation, particularly when the tumor is large, does not often disclose the source of origin. The kind and degree of bone involvement varies considerably. It may be difficult to know whether the tumor is of osseous origin but the size of the soft tissue portion usually indicates its extra-osseous origin.

Microscopic:—The microscopic structure of these neoplasms shows a definite cycle of histologic changes. If the predominate cell is the small plump spindle cell commonly known as the oat cell the tumor may be designated an oat cell tumor. When the cell is of the spindle variety, it may be termed a spindle cell sarcoma. When the spindle cell is replaced by the fibroblast and there is an increasing amount of intercellular substance, the tumor may be called a fibrospindle cell type; when the fibroblast predominates and is scattered among a large amount of intercellular collagenous material, the tumor verges on a benign fibroma and may be termed a fibrosarcoma. This gradual transition from oat cells to spindle cells to fibrospindle cells and to adult fibroblasts permits a definite grading on which a prognosis and the type of treatment may be based.

Tumors of the oat cell type are exceedingly malignant and warrant the most radical treatment. On the other hand, the fibrospindle cell

and fibrosarcomas are very slowly growing and metastasize late despite a tendency to recur locally. The degree of malignancy of the spindle cell sarcoma is between the other groups. Tumor giant cells are absent in these lesions and help to differentiate them from other forms of malignancy.

Prognosis and Treatment:—These depend primarily upon an accurate microscopic analysis, and secondarily on the degree of bone invasion and on the type of involvement of important vessels or nerves. It is not always an easy matter to differentiate these tumors from the more malignant neurogenic sarcomas and the more highly malignant osteogenic sarcomas.

Thirty-one of the cases studied were of the fibrospindle cell variety. Of these, 22 were either of the spindle cell, the fibrospindle cell or the fibrosarcoma type. None of these patients died within a period of five years after treatment. In all cases of primary amputation in which adequate follow-ups are available, the patients were cured and are living from six to twelve years after operation. When local operation was done the tumor invariably recurred. Repeated local operations have never proved sufficient to cure a case, amputation ultimately being required.

The tumor is not particularly radiosensitive. Roentgen and radium therapy is usually not sufficient to cure or prevent a recurrence. The tumor is slow to metastasize and may be held in check from five to ten years by repeated local operation accompanied by roentgen therapy.

Whether to combat the tumor by repeated treatment or insure its eradication by primary amputation depends on its location and the degree of bone involvement. If the local operation is done, it should be followed by deep roentgen or radium therapy. When the tumor recurs, the limb should be promptly amputated.

In 9 cases of the oat cell type a permanent cure was obtained in only one. Tumors of this type offer a bad prognosis; neither local excision nor irradiation offers anything in the way of a permanent cure, and if the location of the tumor permits, primary amputation should be done.

Neurogenic Tumors Involving Bone. In the present series of cases there were 14 tumors involving bone that could be specifically related to nerves in the vicinity, and they were found definitely related to a far larger group of subcutaneous and soft part tumors of known neurogenic origin previously studied. Clinically, pathologically and in the roentgenogram, these neurogenic tumors bear a close resemblance to the lesions of the fibrospindle cell series. There is a gradual transition among the neural tumors from benign neurinoma to the most malignant forms of neurogenic sarcoma. In those neurogenic tumors that invade the bone, the more malignant and cellular forms predominate. Once a neurogenic sarcoma has invaded the bone the chances for cure, no matter how radical the mode of treatment, are practically nil.

Clinical Features:—While the most important points of distinction are not clinical or roentgenologic but relate to the pathologic process and to the response of the neurogenic tumors to treatment, these neoplasms nevertheless present definite clinical peculiarities. The age is well over thirty, duration averages over one year. Bone involvement is more pronounced than in the fibrospindle cell sarcoma. Pathologic fracture may occur. Lesions often resemble metastatic growths. In other respects the roentgenogram bears a remarkable resemblance to those seen in fibrosarcoma of bone. Symptoms referable to nerve involvement are not marked, they are usually related to the bone.

Pathology:—Neuorogenic tumors are less firm and more fleshy than fibrospindle cell sarcoma. They have either a soft and beefy red appearance or are composed of a gray translucent jelly-like myxomatous substance. They show wide dissemination in the soft tissues and the bone and may invade the neighboring joint. Under the microscope, distinguishing features are a faintly staining myxomatous substance that is present in fairly conspicuous areas, the appearance of large tumor giant cells and the tendency for the cells to line up in parallel rows. These tumors may be definitely graded with the microscope.

Prognosis and Treatment:—These tumors recur promptly after local operation and are not radiosensitive. Once osseous invasion has taken place, primary amputation following biopsy is the treatment of choice. Eight patients who were satisfactorily traced, died within two years of the date of treatment, despite the fact that amputation or radical resection was done in six instances. The gloomy outlook in neurogenic sarcoma involving bone is in marked contrast to the results obtained in the group of

fibrosarcomas described in the first part of this paper. The contrast in the results between these two otherwise similar groups of tumors emphasizes the importance of distinguishing between them. Heretofore these tumors have either been loosely classed as parosteal fibrosarcoma or confused with primary sarcoma of the bone.

Osseous Invasion by Miscellaneous Tumors of Connective Tissue Origin. Some unusual form of tumor of the connective tissue series may give a similar clinical picture to the two types of tumors described. Five such cases are herewith recorded. Three were classed as angiomatous, one as a myosarcoma and another as lipoma.

Angioma of the Bone:—The 3 cases reported form a small but strikingly uniform group. All occurred in adults over twenty years of age; there was a history of trauma in each case, with a duration of symptoms varying from eight months to two years, and all involved bones of the upper extremities. The roentgenograms showed the same characteristic and unique soap-bubble effect. The coarsely multiloculated areas of rarefaction expand the shell of bone to paper-like thinness, but do not extend deeply into the medullary or cancellous spaces. The region of involvement is uniformly on the shaft side of the epiphyseal line and does not extend into the epiphysis. In no instance was death or metastases reported, although each of the patients had only a local operation. While included in this paper under tumors that involve bone by direct extension from the soft parts, it is not unlikely that the primary seat of the tumor was situated within the subperiosteal region of the bone in these cases.

Myosarcoma and Lipoma:—Two other cases are included here because of their rarity. One was a myosarcoma originally classed as a fibrospindle cell sarcoma of the periosteum. The other case showed in the roentgenogram a soft part swelling slightly eroding and roughening the internal condyle of the femur. The sections showed a typical benign lipoma.

In all the cases reported in this paper, the initial diagnosis was usually incorrect, and even after the customary pathologic examination, the tumor was in most instances incorrectly classified. The prevalent tendency is to regard these neoplasms erroneously as primarily osteogenic, or to judge them too indiscriminately as fascial sarcoma. As a result, the prognosis and mode of treatment is often on an insecure and improper basis.

From the present study, however, it is clear that each of the various entities warrants individual treatment. In fibrosarcoma invading bone, not of the oat cell type, an attempt to eradicate the disease locally is justifiable, but amputation should be resorted to promptly after recurrence. In the oat cell type, primary amputation when possible is advocated. In the neurogenic sarcoma group producing osseous involvement primary amputation is the treatment of choice. In angioma of the bone, local excision is warranted, preferably reinforced by irradiation since this type of tumor when occurring in the soft parts or subcutaneously gives indication of radiosensitivity. For lipomas, local operation is indicated, and in rhabdomyoma, amputation.—*Karl Kornblum.*

Lantzounis, Leonidas A. Derangement of the menisci of the knee joint; a report of an end-result study of 142 cases treated by operation. *Surg., Gynec. & Obst.*, Aug., 1931, *53*, 182–188.

Mechanical injuries to the menisci occur most frequently during the more active period of life, from sixteen to thirty-five years of age. The medial meniscus is most frequently involved, the ratio being eight to one. The onset of symptoms usually dates from an injury, in the majority of cases the injury occurring while patient was engaged in some athletic sport, and usually with the knee in flexion.

Symptoms. Pain and tenderness, swelling, locking of the joint, slipping sensation in knee joint, weakness and sensation of "giving away," limitation of motion and crepitation are the usual symptoms; they are fully discussed.

Diagnosis is best made from the history and symptoms. Roentgen examination of knees for traumatic lesions of menisci is of very little positive diagnostic value, chiefly because the cartilaginous disc does not throw a shadow. The roentgenogram is valuable, however, in excluding other conditions such as loose bodies, fracture of the tibial spine or tuberosities, osteochondritis dissecans, calcified infrapatellar fat pad, etc., conditions which might simulate the symptoms of a deranged meniscus. In some cases the roentgenogram was of direct diagnostic value by showing an unbalanced joint space, that is, thin on one side and wide on the other. In a very few cases there was definite projection of the capsular shadow at the joint margin on the affected side in an anteroposterior view. This is not positive evidence

of derangement of a meniscus, as the same projection is sometimes noted in other conditions. Preliminary oxygen injection in the knee joint as advocated by some did not result in any definite diagnostic finding in the few cases in which it was tried.

Treatment consists in non-operative measure for the acute cases. The author advocates surgical removal of the meniscus after the acute symptoms have subsided. Eighty-five per cent excellent, and 15 per cent good results were obtained.—*J. H. Vastine.*

FAULKNER, DONALD M. Primary synovial membrane tumors of joints. *Surg., Gynec. & Obst.*, Aug., 1931, *53*, 189–195.

Primary synovial membrane tumors of joints are relatively rare neoplasms. Including the two cases reported by the author there are records in the literature of only 29 cases. Hartman has classified primary synovial membrane tumors under three heads: (1) pedunculated tumors; (2) diffuse tumors with giant cells and (3) diffuse tumors without giant cells. Those tumors with giant cells, the myeloplaxomas of the French, as a rule give a characteristic microscopic picture. The structure is polymorphous, but the elements which make up the tumor are the same in every case. Essentially these tumors are made up of dense, inflammatory connective tissue in the midst of which are three typical findings: (1) the giant cells which are somewhere between the giant cell of bone and the tubercle; (2) the lipoidal or xanthoma cell, and (3) the blood pigment found in and about the macrophagocytes. There are no atypical mitotic figures and no embryonic cells. There is no histologic evidence of malignancy in these tumors. The tumors without giant cells are of diverse types and include the synovioma described by Smith, endotheliomata reported by Wagner, and spindle cell, round cell, large cell sarcoma, vascular fibrosarcoma, and myeloid sarcoma. The tumors without giant cells are of potentially higher malignancy.

Roentgenograms thus far have proved to be of little positive diagnostic aid, the correct diagnosis being made usually at operation. The author suggests that roentgenograms of the joint following an injection would be helpful in establishing a diagnosis.

The history and symptoms in these cases are never definite. The preoperative clinical diagnosis is usually a loose body in the joint, a tuberculous arthritis, or a villous arthritis. As a rule, a mass can be felt in the joint. All of the cases reported have been in the knee and in the ankle, predominantly in the former joint.

Treatment consists in conservative surgical measures. Talbot has made an interesting suggestion in regard to those tumors with giant cells where it is difficult and mutilating to remove all the growth. Recalling the radiosensitivity of giant cell tumors of bones, he said it would appear justifiable to try radiotherapy before proceeding to an extensive synovectomy or a joint resection, with the consequent loss of joint function. Faulkner believes that operation should always be followed by a course of irradiation, but he prefers surgery as the primary treatment. If, after conservative operation, there is recurrence of the tumor with invasion of tissue other than the synovia, high amputation should be performed at once.

Prognosis is generally good. In 29 patients with true primary synovial membrane tumors, there has been a mortality of about 14 per cent, a loss of limb in 14 per cent, and cure, as far as is known, in 72 per cent. There is more than a 50 per cent chance of retaining joint function after a relatively early operation.—*J. H. Vastine.*

BOEREMA, I. Über die Perthessche Krankheit mit besonderer Berücksichtigung des Ischium varum und der Subluxation des Femurkopfes. (On Perthes' disease with special consideration of ischium varum and the subluxation of the femoral head.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Oct., 1931, *44*, 473–480.

Without discussing the disease itself, the author considers the significance of (*a*) the ischium varum (Murk Jansen), and (*b*) the subluxation of the head of the femur occurring in Perthes' disease.

(*a*) The roentgen diagnosis of ischium varum is based on the demonstration of a small foramen obturatorium and of an increased medial prominence of the spina ischii as compared with the normal. In the 25 cases analyzed an appearence of ischium varum was always present, but closer investigations revealed that the roentgenograms were not taken symmetrically, the axis of the sacrum being displaced toward the healthy side instead of intersecting the symphysis. A repetition of the examination with correction of this error led in 9 cases to complete disappearance of the ischium varum. Thus the conclusion is drawn that ischium varum is not the cause of Perthes' disease as

assumed by Jansen but that it is the result of a faulty technique (a slight rotation of the patient towards the diseased side or exaggerated inclination of the pelvis) during the taking of the roentgenogram.

(*b*) The subluxation of the femoral head was found to be real. It most probably is due to gradual flattening of the head of the femur, thus representing a secondary change in the course of Perthes' disease.—*T. Leucutia.*

Hanke, Hans. Zur tuberkulösen Ätiologie von im Röntgenbild sichtbaren Höhlenbildungen in den Handwurzelknochen. (On the tuberculous etiology of the roentgenologically demonstrated cavitations of the wrist bones.) *Fortschr. a.d. Geb. d. Röntgenstrahlen*, Aug., 1931, *44*, 188–197.

Three cases of isolated tuberculosis of the carpal bones which led to breaking down of the bony structure with cavity formation are briefly described. The differential diagnosis includes Preiser's disease (malacia of the os naviculare), Kienböck's disease (malacia of the os lunatum), cyst formations in localized osteitis fibrosa, focal osteomyelitis, lues, etc.—*T. Leucutia.*

Drevon. Un cas de scaphoïdite tarsienne bilatérale. (A case of bilateral tarsal scaphoiditis.) *Bull. et mém. Soc. de radiol. méd. de France*, July, 1931, *19*, 359–360.

The case was first described by the author in 1920, its interesting feature being the bilateral involvement. A recent check-up examination revealed that the condition (11 years later) has completely healed.—*T. Leucutia.*

Stern, N., and Schwabauer, G. Über den sog. Fersenschmerz. (On the so-called heel pain.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Oct., 1931, *44*, 459–472.

The so-called heel pain which is usually designated as talalgia, calcaneodynia, achillodynia, etc., represents a definite disease process. Therefore one should abandon the above terminology and classify the condition according to the pathological changes observed. Through a series of investigations the authors found that the majority of cases of heel pain represent either inflammations and irritations of the bursa of the Achilles tendon, the so-called achillobrusitis, or proliferating changes of the periosteum, the so-called ossifying periostitis (Braizew). In the 23 cases analyzed, isolated achillobursitis occurred in 6, a predominance of proliferating periostitis in 11 and an association of the two in 6. In a certain number of instances the authors also observed a spur formation of the calcaneus, the clinical significance of which is not yet entirely clear.

Most of the patients afflicted were laborers, indicating that repeated irritation is the predominating etiological factor. It was found, however, that infections (also malaria) have a certain aggravating influence.

Numerous roentgenograms are used in the text for the illustration of the various conditions.—*T. Leucutia.*

BLOOD AND LYMPH SYSTEM

Pepper, O. H. Perry. The history of agranulocytic angina. *J. Am. M. Ass.*, Oct. 10, 1931, *97*, 1100–1101.

Schultz in 1922 recognized the syndrome later given the name agranulocytic angina by Friedemann, but the disease undoubtedly existed and was recognized and described clinically many years ago, though of course without reference to the blood picture. MacKenzie in 1880 described this condition under the heading "putrid sore throat," giving credit to Gubler and Trousseau who differentiated it from diphtheria in 1857 and 1865 respectively. The writers of that period described a gangrenous pharyngeal membrane with ulcerations, an occasional tendency to hermorrhage from lungs, bowels, nose and mouth and petechial hemorrhage in the skin accompanied by marked prostration. By the beginning of the twentieth century the disease had been dropped from textbooks and its next appearance was under its present name.—*E. W. Hall.*

ROENTGEN AND RADIUM THERAPY

Santoro, Angelo. La radiumterapia del cancro della mammella. (Radium therapy of cancer of the breast.) *Radiol. med.*, Aug., 1931, *18*, 1045–1054.

The author describes his technique for giving radium therapy in cancer of the breast. He uses a mold covering the whole breast and the territory of the tributory glands. De Nobias recommends Columbia paste for the mold but he finds that this has several disadvantages and particularly that it is too hot in summer. So he uses several layers of gauze which can be fitted accurately to the part and are cool enough to be worn at any season of the year.

The radium tubes containing 10 mg. radium each are fastened on bases of cork or some other material of low atomic weight and attached to the mold in checker-board fashion at distances of about 8 cm. from each other and 3 cm. from the skin. This gives an equivalent of 5 mg. radium at every point on the surface of the skin and of 2–3 mg. radium in the deep tissues, depending on the thickness of the tissue. This of course requires about 100 to 150 mg. radium depending on the surface to be covered. The treatment requires twenty to twenty-five days. Treatment for this length of time causes an intense erythema which is followed by desquamation and pigmentation. The treatment has never caused any serious disturbance. Sometimes there is slight nausea and loss of appetite, dryness of the mouth, headache and turbidity of the urine. After the treatment the patient generally has a period of depression for about three weeks but following that is completely well. In favorable cases the tumor and gland metastases begin to recede during the treatment and disappear completely within two months. If necessary the treatment may be repeated at the end of two months.

All of the author's cases were ones of recurrence after operation which are the most serious form of all, for the local recurrence is generally accompanied by gland metastases and often metastases in other organs, particularly the bones, and these metastases may have been latent at the time of the radium treatment. If the recurrence is only local the treatment may result in complete recovery. Two such cases are described. When there are gland metastases, particularly in the supraclavicular fossa, the prognosis is not so good, but even in these cases prolonged improvement may be brought about. Two cases of this type are described. If there is diffusion to the pleura with liquid effusion, radium treatment is generally poorly tolerated and the patient may grow worse with increase of the pleural effusion. This type is also illustrated by two cases. A seventh case is described in which a local recurrence disappeared under radium treatment. After four months, bone metastases developed and these have been greatly helped by roentgen treatment.—*Audrey G. Morgan.*

KELLY, HOWARD A. Radium in the treatment of menstrual disorders. *J. Am. M. Ass.*, Sept. 12, 1931, *97*, 760–763.

In 30 cases of excessive menstruation in young women with nervous disorders and secondary anemia small doses of radium were very beneficial, normal periods returning and remaining normal in the majority of cases. The average dose was 583 millicurie-hours. In menstrual hemorrhages in patients under forty, roentgen rays and radium are a last resort, but at the time of the menopause a dose of 1,200 to 1,500 millicuries is indicated for hemorrhage in cases where malignancy or other pelvic disease has been excluded. Fibroid tumors respond well to roentgen rays and radium, most fibroids shrinking materially or totally disappearing in a few months. Tuberculous patients with exacerbations at the menses are benefited by sterilization by roentgen rays. In 10 cases of migraine associated with menstrual disorders, the majority showed improvement and only one seemed aggravated. In dysmenorrhea other measures are used and roentgen rays and radium are employed only in extreme cases and in small dosage, the results being not very encouraging.—*E. W. Hall.*

KAPLAN, IRA I. Radiation therapy of carcinoma of the rectum. *J. Am. M. Ass.*, Oct. 3, 1931, *97*, 991–994.

Rectal carcinoma is said to form one-third of all cancers affecting the body and to be third on the list of cancers of the rectum causing death. Neither surgery nor irradiation offer very favorable results but the results of irradiation are equally as good as those of surgery. The greater number of rectal lesions occur in the lower portion and are relatively accessible. The appearance of the lesion gives little clue to its age, and the clinical symptoms are likewise misleading, due to the mildness of the disturbance caused by small lesions.

Treatment includes (1) general measures; (2) high voltage roentgen therapy through five portals; (3) radium treatment directly to the lesion, and (4) post-irradiation treatment. Colostomy is not advised unless radical resection of the rectum is contemplated or practically complete occlusion of the lumen has occurred.

A special applicator for radium and a newer method of administration are described.—*E. W. Hall.*

SCHMITZ, HENRY. Choriomas *Am. J. Obst. & Gynec.*, Feb., 1931, *21*, 256–263.

Choriomas are grouped as follows: Benign—simple hydatid mole; invasive hydatid mole. Malignant—chorionepithelioma. Diagnosis is

made from the symptoms, the history, tissue examination and hysterosalpingography, though this must be employed with caution due to the possibility of forcing chorion through the tubes. The Aschheim-Zondek reaction is of differential value.

Schmitz reports 8 cases of chorionepithelioma: 2 cases in which radium was introduced into the uterus and roentgen therapy was employed externally have remained well, 13 years and 2½ years respectively; 3 cases in which roentgen therapy was employed as a postoperative measure have all remained well 2 years, 1½ years, and 1 year respectively; one case in which roentgen therapy was used to treat metastases to the brain and elsewhere died in 3 months; 2 patients were operated upon with no postoperative treatment. One of these died 19 days after operation and one has remained alive and well for 1½ years.

Schmitz concludes that irradiation alone or as a postoperative measure is definitely indicated in these cases.—*J. H. Vastine.*

Pfleiderer, A. Statistischer Beitrag zum Uteruskarzinom und seiner Behandlung. (Statistics on treatment of carcinoma of the uterus.) *Strahlentherapie*, 1931, *40*, 13–43.

A report is given on 956 cases of carcinoma of the cervix treated from 1902–1923. Of these 615, or 64.3 per cent, were operable and 341, or 35.7 per cent inoperable. Absolute cure was accomplished in 186 of the 956 cases, or 19.4 per cent. Relative cure was accomplished in 181 of 615 operable cases, or 29.4 per cent, and in 5 of 341 inoperable cases, or 1.4 per cent. There were 445 cases treated by the radical Freund-Wertheim operation alone without irradiation and 132 of these were cured, or 29.6 per cent. Among the 553 cases of radical operation with or without irradiation, counted together as otherwise all the primary deaths would fall in the non-irradiated group, there were 181 cures, or 32.7 per cent. The primary mortality among all the radically operated cases was 107, or 19.1 per cent. Among the patients given radical operation without after-irradiation, 339 were discharged well; of these 201 recurred, or 59.2 per cent. Among the cases given radical operation and after-irradiation 95 were discharged well; of these 50 recurred, or 52.6 per cent. With irradiation alone 3 of 47 operable cases were cured, or 6.8 per cent and 3 of 125 inoperable cases, or 2.4 per cent.

There were 216 cases of carcinoma of the body of the uterus, 176 of which, or 81.4 per cent, were operable and 40, or 18.6 per cent, inoperable. Among the total of 216 cases there was absolute cure in 85, or 39.3 per cent; there was relative cure in 85 of the 176 operable cases, or 48.3 per cent, and in none of the inoperable cases. There were 137 cases treated by radical operation or total vaginal extirpation without irradiation; of these 66, or 48.1 per cent, were cured. Among the total of 163 cases operated on with or without irradiation 84, or 51.5 per cent, were cured. The primary mortality among all the operated cases was 16, or 9.8 per cent.—*Audrey G. Morgan.*

Schreiner, Bernard F. Results of irradiation treatment of myoma of the uterus, based on a study of 318 cases. *Radiology*, Aug., 1931, *17*, 265–270.

In this series of cases, the fibroids varied from about twice the size of a normal uterus, nodular, up to the size of an eight- to nine-months pregnancy. About 92 per cent of the growths occurred in the body of the uterus, only 8 per cent in the cervix. All varieties and combinations were observed; submucous, interstitial, and subserous, a few of the latter being pedunculated.

Treatment, consisting of external irradiation by high voltage roentgen ray at 80 cm. distance; filter 0.5 mm. copper, 1 mm. aluminum; size of field 20× 20 cm.; two fields, one anterior and one posterior, was administered in two or four sittings on successive days. There was little, if any, disturbance, such as nausea, vomiting, or loss of time, from this method. The factors varied according to the thickness of the patient, an effort being made to put from 40 to 50 per cent in the ovaries and tumor mass. The same factors were used for "temporary sterilization" in which 28 to 35 per cent was administered to the tumor and the ovaries. This was particularly applied to patients below the age of thirty-five, in whom an effort was made to control bleeding and to cause diminution in the size of the tumor, with the hope that menstruation would re-establish itself. In some instances radium packs were used at 6 cm. distance, field 6.5×7.5 cm., with filter of silver 0.5 mm., brass 2 mm., aluminum 1 mm., rubber 1 cm., using two or three fields through the lower abdominal wall. At this distance 17 per cent was administered at 10 cm. depth. Radium tubes were usually used in tandem, inserted in the body of the uterus, filtered through 0.5 mm.

gold, 0.5 mm. brass, and 1 mm. rubber, varying, according to the size of the tumor and the distance of the tubes from the ovaries, from 600 to 800 mg-hr. of radium up to 1,600 mg-hr.

In cases recorded as having been treated by a combination of radium and external radiation, radium was inserted and allowed to remain for periods of from 1,200 to 1,600 mg-hr., and the total dose supplemented by 25 per cent of the skin dose in the ovary, administered by high voltage roentgen rays. These treatments were administered at the time of the curettage, which was precautionary, so that malignancy of the fundus would not be overlooked.

A more careful selection of the cases for irradiation, especially with radium, should be encouraged, particularly when there is a suspicion of an associated malignancy in the fundus. It is essential that the physics of this agent be thoroughly understood. One finds that doses of radium, from 600 to 700 mg-hr., up to 2,400 mg-hr., are given by various operators for the control of this disease. It is easy for the casual observer who is not acquainted with the facts to do damage by leaving a single tube in a certain position in the uterus for from 2,000 to 2,400 mg-hr., not keeping in mind that one author uses platinum of 1 mm. thickness, another uses lead of 2 mm. thickness with rubber immediately surrounding the tube. Greater accuracy in the description of the tubes, i.e., length, amount of radium contained, thickness of the capsule, size of the tumor, etc., all are problems which have to be taken into consideration.

Many of the contraindications which are set up by the gynecologist can be overcome if these physical principles are kept in mind. For example, myomatous uteri, the size of a six- to eight-months pregnancy, without any degenerative inflammatory changes, can be, in selected cases, taken care of by external irradiation alone. The author has seen such tumors atrophy so that the remnants of the growth were about the size of a three-months pregnant uterus. This type of case would not be suitable for intrauterine application of radium. Even submucous fibroids can be so influenced by external irradiation alone that a good result is obtained. On the other hand, submucous fibroids presenting in the vagina or cervix would better be treated by removal of the fibroid, followed by the application of radium in the uterus, or external irradiation following the removal. Associated lesions, such as ovarian cysts, salpingitis, circulatory disturbances in the tumor, calcified tumors, or some of those showing marked degenerative process, would naturally best be treated surgically.

It is of importance not to overlook associated malignancy. However, in the author's series only 9 cases were observed associated with fibroid—5 of fundus carcinoma, 3 of epithelioma of the cervix, and one of carcinoma of the ovary. In his entire series of 1,993 gynecological cases, 318 were fibroids, while only 11 were malignant myomas. From these figures one can readily see that malignant myoma is not a common disease, and that the tendency of myoma to become malignant is not great. All of his cases of malignant myoma were postoperative, and all but one that was treated prophylactically, had recurred.

The bleeding is controlled in from 96 to 100 per cent of the cases. The size of the tumor is definitely influenced in 85 per cent of the cases treated, there being regression to normal or at least a diminution to 50 per cent of the original size. Of the cases reported, 98.5 per cent were symptomatically well. The menopausal symptoms—neurosis, hot flashes, sweating—do not seem to be any more severe after irradiation than in the average menopause, with a few exceptions.—*J. D. Camp.*

FRITSCHI, G. Die Kastration bei der Frau mit Röntgenstrahlen. (Castration of women with roentgen rays.) *Strahlentherapie*, 1930, *38*, 739–753.

The method of irradiation used for permanent castration at the Zurich Gynecological Clinic has been changed from time to time, the change being in the direction of decreased dosage by the use of heavier filters and decreased irradiation time. They now use a symmetry apparatus, Coolidge tube, 2 ma., about 180 kv., maximum tension, focus-skin distance 30 cm., filter 1.2 mm. copper and 1 mm. aluminum. Tables are given showing the half-value layer in copper and the dose per second at the surface and in the deep tissues with the various methods. The size of the fields has also been decreased from 18×24 cm. to 18×18 cm. One field on the back and one on the abdomen is irradiated. Patients irradiated for more than fifty minutes showed moderate to intense browning of the skin while those irradiated for less than fifty minutes showed only slight browning or even no erythema at all. All of the

women have remained permanently amenorrheic.

In the beginning doses as high as 2000 r were used in some cases. But there were no late injuries in the cases given a dosage of from 1500 to 2000 r. There were, however, 15 cases of mild late injury with doses between 1000 and 1500 r. The author believes there is some danger of late injury with doses above 1000 r. With two fields and a focus-skin distance of 30 cm. and the above conditions he has found that a dosage of about 600 r is enough for castration. With their filtration and a surface dose of 600 r there is almost never erythema.

They have further simplified their technique by the use of Metalix double tubes, irradiating back and abdomen at the same time. This requires only half as much time as by the former method.—*Audrey G. Morgan.*

Joly, Marcel. La stérilisation temporaire röntgénienne est-elle un procéde thérapeutique légitime? (Is temporary roentgen sterilization a legitimate therapeutic procedure?) *Bull. et mém. Soc. de radiol. méd. de France*, April, 1931, *19*, 156–158.

A temporary sterilization of females by roentgen therapy is indicated in tuberculosis, advanced cardiac conditions or severe adnexitis, but is definitely contraindicated as a social measure in women married to epileptics or mentally deficient where a sterilization of the husband would appear more logical. In hyper- and polymenorrheas, the irradiation of the spleen or of the ovaries with moderate doses will lead in the majority of instances to satisfactory results without producing temporary sterilization. It is therefore advised that one be as conservative as possible, reserving the procedure for conditions in which other methods have proved of no avail.—*T. Leucutia.*

Ganzoni, M., and Widmer, H. Über die therapeutische Schwangerschaftsunterbrechung durch Röntgenstrahlen. (Therapeutic abortion by roentgen rays.) *Strahlentherapie*, 1930, *38*, 754–761.

Fürst rejects roentgen abortion as dangerous on account of infection, but in their 63 cases the authors have never seen any such ascending infection. The advantages of roentgen abortion as compared with operation are that it is a harmless, sterile method that does not require anesthesia and can be undertaken even with weak, bedridden patients; if the women are not very ill ambulant treatment can be given. There are none of the dangers of operation such as infection and thrombosis. Its disadvantages are that there may be a considerable interval between the irradiation and the abortion, there may be quite long continued hemorrhage, though in the authors' cases this was very rare, and there may be castration and signs of loss of ovarian function. The women must come back for examination every two weeks. There was very little complaint of signs of the menopause in the author's cases but the patients were working women and peasant women who had something to do besides think of their health.

The exact indications for the method are yet to be determined. It gives good results when sterilization as well as abortion is indicated. It is absolutely free of danger. Abortion can now be brought about with a skin dose of 60–85 per cent of an erythema dose and certainly no late roentgen injuries are to be feared from that.—*Audrey G. Morgan.*

Zwerg, H. G. Der derzeitige Stand der Radiumchirurgie. (The present status of radium surgery.) *Strahlentherapie*, 1930, *38*, 487–498.

Complete radiosurgical treatment consists of three parts: first, the tumor is exposed by surgical operation, then it is treated with radium, generally by means of needles but sometimes by flexible or modelled carriers and then the local lymph glands are irradiated. This latter irradiation may be by roentgen rays. This method is particularly indicated in tumors of the skull, face and accessory sinuses. In tumors of the hypophysis the nasal septum is resected under local anesthesia and the sphenoid sinus opened. A radium tube containing about 40 mg. is inserted and kept in place with a gauze tampon for about twelve hours. This method is not entirely without danger, particularly if there is any infection of the nose and ethmoid cells. Generally in tumors of the hypophysis only the pressure symptoms can be relieved, not the disturbances of internal secretion.

Careful dosage is necessary in radiosurgery of the nasal sinuses in order to prevent inflammation of the orbit. Radium tubes with 2 mm. platinum filtration and a dose of 50–100 mg. radium should be left in not more than 24–36 hours. In carcinoma of the larynx needles are not used but a flat capsule about 2 cm. long and 1.5 cm. broad containing 10–15 mg. radium element, filtered through 1 mm. platinum. The posterior wall of the carrier should be covered

with 1 mm. lead to protect the surrounding soft parts from the irradiation. The immediate results have been extremely good in this form of carcinoma; it is too soon yet to judge of the permanent results.

In carcinoma of the esophagus, a gastrostomy is first performed and the patient's general condition improved by feeding. The patient is then given a silk thread with a lead shot on the end of it to swallow and observed on the roentgen screen until it passes into the stomach; it is then caught and brought out at the gastrostomy opening and the stomach end and the mouth end tied together. Two brass tubes containing 30 mg. radium each are drawn down into the stenosis or if the stenosis is impermeable one tube is drawn down from the mouth and another up from the stomach to it. The results of this method are much better than those of any other method of radium treatment and life is prolonged much longer.

The results of radiosurgery are better in carcinoma of the bladder than those of any other method of treatment. The method seems to be a failure in carcinoma of the prostate, probably because of the early metastases. Other forms of cancer in which radiosurgery gives good results are carcinoma of the stomach and carcinoma of the internal female genitalia.—*Audrey G. Morgan.*

DE VECCHI, LUIGI. Il carcinoma della mucosa della guancia. (Carcinoma of the mucosa of the cheek.) *Radiol. med.*, Dec., 1930, *17*, 1399–1432.

Case histories are given of 28 cases of carcinoma of the cheek which the author treated with radium; 74 per cent of the patients were smokers or chewers of tobacco and in 36 per cent of them the carcinoma developed on a leucoplasia. All of the patients were men in the third to the sixth decades of life. All of the tumors examined were of the spindle-celled type. Enlarged glands removed were histologically positive in 57 per cent of the cases; the rest were simply hyperplastic or inflammatory. Among the 28 cases treatment was temporarily successful in 7; these patients are now clinically well after periods of from six to eighteen months. Some of the cases were treated with radium needles and some with external apparatus with Columbia paste. The author concludes that the best treatment is a combined treatment, that is, exclusively radium treatment for the primary tumor and chiefly surgical for metastatic adenopathies.—*Audrey G. Morgan.*

PFAHLER, G. E., and VASTINE, J. H. Radiation therapy in cancer of the mouth; with especial reference to the use of pure gamma rays. *J. Am. M. Ass.*, Feb. 28, 1931, *96*, 664–669.

Pure gamma radiation therapy in cancer of the mouth under present conditions as to stage of diagnosis should produce 50 per cent of cures and if patients reported for treatment earlier, 75 per cent should be cured. In skilled and experienced hands, with proper equipment, it is the method of choice for mouth cancer since it is painless on application, requires no hospitalization, there being few or no constitutional symptoms, does not mutilate, produces no important skin changes, and is effective not only in clearing up the lesion but neighboring nodes as well. It is, however, very expensive due to the amount of radium necessary, requires patient cooperation of the subject, and very close observation by the radiologist himself.

Radium packs are used externally and from 20,000 to 50,000 miligram-hours are given, with 3 mm. of lead or its equivalent as a filter, the distance being 4 cm. Intraoral treatment is also given. The aim is to produce and maintain a deep erythema for several weeks and, in the case of the mucous membranes, to produce blanching. Desquamation usually follows. The usual measures to promote oral hygiene are employed.

Of 111 patients treated by this method 39 have been symptom-free for from one to five years and 19 are still under treatment with excellent prognosis.—*E. W. Hall.*

SMITH, GEORGE G. The treatment of bladder carcinoma by irradiation and diathermy. *J. Am. M. Ass.*, Dec. 6, 1930, *95*, 1730–1734.

Fifty cases are studied, of which 11 were treated by excision, 15 by electrocoagulation and 24 by irradiation. Detailed tables giving age, location, type of tumor, method of treatment and result accompany the text. Forty-seven of the cases had microscopic diagnosis. In general, infiltrating tumors of the dome or lateral wall were excised if possible; scattered superficial tumors were treated by electrocoagulation. Infiltrating tumors of the base or trigone were best treated by irradiation. Irradiation consisted of the implantation of glass or gold seeds of about 1 mc. each, about 1 cm. apart through the tumor and about its peri-

phery, the dosage varying between 1,320 and 3,800 mc-hr. Smaller doses were apparently as effective as the larger. Of the cases treated by surgery and diathermy, the former had the greater operative mortality, the latter the greater percentage of recurrence. Successful results were obtained in 25 per cent of the cases for the entire group.—*E. W. Hall.*

Barringer, B. S. The radium treatment of cancer of the bladder. *J. Am. M. Ass.*, Dec. 6, 1930, *95*, 1734–1736.

This series consists of 127 cases, of which 98 were diagnosed pathologically, and includes tumors considered both operable and inoperable. The trigone was involved in 63 per cent of the tumors and it is believed the operative mortality of surgical removal of these would have been between 10 and 20 per cent, with many classed as inoperable. Of 109 cases of suprapubic implantation, only 3.6 per cent operative mortality occurred, these cases being poor general risks. Choice between screened (gold seed) and unscreened (glass seed) radiation is difficult, many tumors seeming to respond better due to the effect of the beta rays. The small dose is the common cause of failure to cure. Each square centimeter of tumor should receive a 2 mc. seed and the total radiation necessary may be as high as 15 skin erythema doses in radioresistant tumors. Such a dose is impossible with roentgen rays. Control of the tumor for more than three years was obtained in 55.5 per cent of the papillary carcinomas and 27.5 per cent of the infiltrating type.—*E. W. Hall.*

St. Liebhart, and Meisels, E. Über die sogenannten Spätschädigungen nach Radiumbestrahlengen in der Gynakologie. (So-called late injuries after radium irradiations in gynecology.) *Strahlentherapie*, 1931, *40*, 508–514.

With perfection of technique in irradiation, cases of early injury have become very few, but there are still quite a number of reports of late injuries of the skin. Cases of late injury of the genitalia after irradiation are rare however. The authors describe a case in a multipara aged fifty-nine who was given combined roentgen and radium irradiation for carcinoma of the cervix. She was given 16 roentgen irradiations on two back and two abdominal fields within sixteen days. The individual doses were 6 Holzknecht units, with 0.5 mm. zinc and 2 mm. aluminum filter, Symmetry apparatus, spark gap 42 cm. After an interval of six weeks she was given the first radium application of 50 mg. filtered through 2 mm. platinum, applied intravaginally for twenty-four hours. This same dose was repeated after one week and again after four weeks. She was given a total of 3,600 mg-hr. She bore the treatment well and left the hospital greatly improved subjectively and objectively. After two years she came back with an ulcer of the vault of the vagina extending to the rectovaginal septum that looked like a carcinomatous ulcer. It seemed certain that further radium treatment would cause a rectovaginal fistula so she was given conservative treatment with baths and paste. After four weeks' treatment the ulcer healed and she was discharged well subjectively and objectively.

It was hard to make a diagnosis of late injury in this case as the ulcer looked like a carcinomatous one. The results of conservative treatment proved, however, that it was a late injury from irradiation and not a carcinoma recurrence.—*Audrey G. Morgan.*

Pitts, Herman C., and Waterman, George W. Report of results of radium treatment of carcinoma of cervix. Ninety-two cases treated from 1921 to 1924 at the Rhode Island Hospital. *Am. J. Obst. & Gynec.*, Nov., 1930, *20*, 607–611.

The technique employed for the cases reported was 11 mg. of radium (2–50 mg. capsules) in the cervical canal, filtered through 0.5 mm. silver, 1 mm. of brass and 4 mm. of rubber at a distance of 5 mm. In addition 100 mg. of radium in capsules were placed in the vagina against the cervix. Ten 5 mg. steel needles were introduced interstitially at the apparent margin of the growth; 3,500 to 5,000 mg-hr. were given in two or three divided doses at two to three week intervals. By this technique they obtained an absolute 5-year cure of 17.4 per cent of 92 cases. They had a 5-year cure of 57.9 per cent of the 19 early or operable cases.

The technique which they now employ consists in the introduction interstitially about the cervix of radium needles containing 1 to 4 mg. filtered through platinum walls. A 20 mg. platinum capsule of radium is introduced into the cervical canal. All of this radium is left in place six to seven days (144 to 168 hours), thus giving 7,000 to 10,000 mg-hr. of gamma radiation, distributed in multiple small foci in and

about the growth. In addition to the above treatment, high voltage roentgen treatments are routinely given externally. They have not employed this improved method long enough to know what change it will make in their 5-year cures but they feel that their immediate results are much improved.—*J. H. Vastine.*

JONES, THOMAS E. A comparison of the results of surgery and of radiation in the treatment of cancers of the cervix; an analysis of 200 cases subjected to radiation treatment. *Am. J. Obst. & Gynec.*, Feb., 1931, *21*, 187–195.

Notwithstanding the numerous articles which have been written and the publicity which has been given this subject, the cases presenting themselves at the Cleveland Clinic in 1929 were just as far advanced as the cases seen in 1920.

Investigation has disclosed that hysterectomy for carcinoma of the cervix is still in vogue in the smaller localities, while it has practically been discarded in the larger centers. Wertheim, by his radical operation, was able to cure 18.02 per cent of the cases of cervical carcinoma. He found only 48 per cent of the cases operable, so he in reality cured only 9 per cent of the cases which came to him. Jones quotes the following as preferring irradiation to surgery in the treatment of carcinoma of the cervix: Norris, Crossen, Kelly, Ward, Lynch and W. J. Mayo. The opinions of these eminent men cannot be disregarded, and it is reasonable to say that until some better treatment is discovered, radiation therapy is the best treatment for cancer of the cervix.

With regard to etiology, the author emphasizes the relation between chronic irritation and cancer. In a series of 5,000 cases studied by Graves, in which cervical repair had been done, only 4 patients later developed malignancy.

Diagnosis is considered. The author feels that biopsy is harmless and is indicated in doubtful cases. Classifications as devised by Broders, Martzloff, and Hueper are discussed and believed by Jones to be valuable in prognosis.

Technic of radium therapy. At the Cleveland Clinic, the author uses radium filtered through 1.5 mm. of brass and 3 mm. of rubber, placed in and about the cervix and in the fundus, a total of 3,600 mg-hr. being given. Roentgen therapy is used externally in all cases.

Complications such as hemorrhage, and rectal and bladder symptoms are discussed.

Results. Jones obtained 25 per cent five-year cures by irradiation. This includes treatment of practically all cases, advanced as well as the early. It represents cases treated prior to 1925. The technique has been improved since that time. Including the more recent cases, 54 per cent are alive from one to three years following treatment. All cases which could not be traced are regarded as dead. The average duration of life of patients who died was fourteen and one-half months.—*J. H. Vastine.*

DE BUBEN, IVAN. Radium in the treatment of cancer of the vagina. *Surg., Gynec. & Obst.*, April, 1931, *52*, 884–886.

Cancer of the vagina is the most malignant of cancers of the female genitalia. Primary vaginal carcinoma is rare, constituting about 2 per cent of the cancerous growths of the female genitalia. It usually occurs in women past the climacterium.

The author has observed 29 cases since 1910. The youngest patient was twenty-seven years of age and the oldest seventy-one.

The etiology is obscure. Leucoplakias and irritation from pessaries seem to predispose. The parity of the patients bears little relation to the incidence. The upper posterior wall is the most frequent site. The squamous cell is the usual histological type. Due to the usual location on the posterior vaginal wall, extension to the rectum is common and rectovaginal fistula usually results. Metastases to remote organs are infrequent.

Diagnosis can only be definitely made histologically, since the general appearance of the vagina in the presence of cancer is very similar to that of senile vaginitis, sarcoma, tuberculous ulcer, hard ulcer, and decubitus caused by pessary or foreign body.

Treatment by surgical measures is discussed. The radical operations as advised by Wertheim for the total extirpation of the entire genital tract by the abdominal route, that advised by Schauta for removal by the vaginal route, that by Olshausen by the perineal route, that by Fritsch and Kelly by the sacral approach are discussed. The author states that only 50 per cent of the cases are operable when first seen. The primary operative mortality is necessarily high in such extensive procedures, and recurrence occurs after a short interval in 90 per

cent of the cases which survive the operation. It can be seen that surgery offers little in this condition.

The use of radium and roentgen radiation combined seems to be the most advisable means of treatment. Great skill is necessary in the use of the radium to prevent rectal injury. Of the 29 cases observed by the author, the first was treated surgically. The remaining 28 were treated by irradiation, of which 9 are still living for 9, 6, 4, and 2 years, and 5 for periods of less than 2 years. The results are obtained with a minimum of inconvenience and discomfort to the patient, and good palliation can be expected in the cases in which a permanent cure is not obtained. The author quotes the literature in which Gal reported on 10 cases of carcinoma of vagina with 20 per cent 5-year cures by irradiation. Bumm reported on 22 cases treated by irradiation with 22 per cent well for periods of 3 to 6 years. Phillip and Gonick reported on 53 cases treated by irradiation with 13 per cent 5-year cures. Giesecke reported 13 per cent cures in 22 cases. Heyman reported 12.5 per cent cures. Bagg, Bayley, Cahen, Delporte, Franque, Ikeda, Lehocky, Semmelweis, Polubinsky, Starry and Warnekros report similar results.—*J. H. Vastine.*

Speierer, Carl. Röntgen- oder Thalliumepilation bei Mikrosporia? (Roentgen or thallium epilation in microsporia?) *Strahlentherapie*, 1931, *41*, 395–400.

Recurrence is not as frequent after roentgen epilation as after thallium epilation. Some authors attribute this to the fact that the loss of hair is more complete after the use of roentgen irradiation, while others say that it is because the rays kill the fungi directly. The author experimented with roentgen irradiation of cultures of microsporia and found that the rays do not kill the fungi directly but that they affect the culture medium in such a way that their future growth is prevented. Microsporia grew again when transferred to fresh medium. Irradiation has a threefold effect: it inhibits the growth of the microsporia though it does not kill them, it brings about an allergic change in the skin and changes the hydrogen ion concentration of the skin in the acid direction, which injures the fungi. Thallium does not destroy the fungi or affect the skin. It acts indirectly through the central nervous system and does not cause any inflammatory or histological changes in the epilated skin. Roentgen epilation is therefore unconditionally the method of choice. Not only is it more effective but it is also less dangerous.—*Audrey G. Morgan.*

Rawling, L. Bathe. A contribution to the surgery of the pituitary region; an account of four cases of "pituitary tumour" treated by radon seeds. *Brit. J. Surg.*, July, 1931, *19*, 68–77.

The surgical approach to the pituitary region by means of a lateral frontal bone flap is described as well as the "blind insertion" of radon seeds through a slit in the dura, by means of a blunt director. The number of radon seeds was determined by the severity of the symptoms and the amount of bone destruction as revealed by roentgen examination. The author presents 4 cases with films indicating the distribution of the seeds. Autopsy in two of these cases, however, showed large areas of the tumors with no radon seeds. This series of four cases, three of whom died, is too small to indicate what might be expected from this procedure. The author believes, however, that further experience with this procedure will make it of great value.—*F. H. Decker.*

Herzog, A. Zur Kasuistik der geheilten Uterussarkome. (Case of cured sarcoma of the uterus.) *Strahlentherapie*, 1931, *42*, 198–200.

A case is described in a very stout patient fifty-one years of age in whom gynecological examination showed tumor of the uterus and curettage and histological examination showed polymorphous celled sarcoma. She refused operation and was given an irradiation of 10 H on four fields with 30 cm. distance and 0.5 mm. zinc and 1 mm. aluminum filter. This stopped the hemorrhage. She came back at irregular intervals for three years and was irradiated. The hemorrhage was held in check and the tumor decreased in size. But the last irradiation at the end of October, 1928, had no effect; bleeding began again and the uterus increased in size. Three weeks after this irradiation the uterus was as large as two fists but the parametrium seemed to be free. Radical operation was performed under lumbar anesthesia. Recovery was uneventful and now, three years later, the patient has no signs of recurrence.—*Audrey G. Morgan.*

Ostreil, A., and Novak, F. V. Anwendung langdauernder radioaktiver Induktionen in der Medizin. (Use of long-continued radio-

active inductions in medicine.) *Strahlentherapie*, 1931, *42*, 291–306.

In the ordinary use of radium only the gamma rays are utilized which constitute only about 4.7 per cent of the total irradiation. The authors believe that it would be of great value to utilize the alpha and beta irradiation by keeping radioactivated substances in contact for a long time with pathological tissues. They experimented with various substances and found that tungsten and silver could be activated by exposing them to radium emanation in a medium of olive oil. A mixture of olive oil and silver emulsion 150:30 was activated with 18 millicuries radium emanation and kept in a vessel closed with wax for two months. Measurement with the electroscope showed that the deposited silver particles were activated. When such an activated solution is injected its activity is preserved for a long time and it continues to act on the tissues. Such silver and tungsten emulsions were injected into the organs of animals and autoradiograms of the organs showed that the alpha and beta particles in the organs are capable for a long time of affecting the photographic plate. A description is given of the histological changes found around such an injection. The emulsions were also used in 5 clinical cases, one of carcinoma near the sphincter of the rectum, one of epithelioma of the lower lip, one of epithelioma of the left angle of the mouth, one of epithelioma of the ear and one of epithelioma near the eye. Two of these cases have been followed up and they show considerable improvement. Photographs are given of the carcinoma of the lip before and after treatment.—*Audrey G. Morgan.*

HÜFFER, E. B. Zur symptomatischen Behandlung der Katererscheinungen nach Röntgentiefenbestrahlung. (Symptomatic treatment of roentgen sickness after deep roentgen therapy.) *Strahlentherapie*, 1931, *42*, 181–188.

Various remedies have been suggested for roentgen sickness based on the changes found in the blood after irradiation. None of them have proved very satisfactory. The author therefore decided to try remedies that would exclude the vomiting center. He tested nautisan and vasano. Nautisan is a combination of trichlorisobutylalcohol and trimethylxanthin. The former is the essential constituent of Mothersill's seasick remedy and the latter has a stimulating action on the cerebral cortex. Vasano is a combination of hyocyamin and scopolamin in the proportion of 3:1, in which the vagus-paralyzing action of hyoscamin is strengthened by that of scopolamin and the central-stimulating action of the hyoscyamin is neutralized by the central-paralyzing action of the scopolamin.

He had excellent results with nautisan and almost as good ones with vasano. Among 18 cases treated with nautisan only one was not affected. Two others vomited but the sickness was much less intense than it had been after another series of irradiations in which the drug was not given. When both nautisan and colsil were given the results were not particularly better than with nautisan alone.—*Audrey G. Morgan.*

MUSGER, ANTON. Zur Kombination Elektrotomie-Radiumbehandlung der Hautkarzinome. (Combined electrotomy-radium treatment of skin carcinomata.) *Strahlentherapie*, 1931, *42*, 143–147.

The author reports 50 cases of skin carcinoma treated by a combination of electrotomy and radium irradiation. The carcinomatous tissue was excised with a wire loop as an operating electrode. This was done under local anesthesia. Radium irradiation with 70–80 per cent of a skin erythema dose was then given 5 to 8 times at intervals of 1–2 days, using plates or Dominici tubes, depending on the size of the surface to be irradiated. After primary healing one or two prophylactic after-irradiations were given.

Most of the cases were cancer of the face, chiefly pavement epithelial cancers; the others were basal cell carcinomas or prickle-cell cancers. On comparing these cases with those treated by radium alone, the author comes to the conclusion that the time required for healing is considerably shorter with the combined method and the results very satisfactory. The scars are not any worse from a cosmetic point of view than those after radium alone. It is impossible to judge the late results as the oldest cases were treated eight months ago. The amount of radium irradiation required is a little less than half that when radium alone is used. Electrotomy can be used without any danger even for old and weak patients. The electrical excision not only removes the tumor tissue but cauterizes the wound surface and kills the superficial tumor cells, thus decreasing

the danger of local recurrence. It also closes the small blood and lymph vessels and decreases the danger of dissemination of the tumor. The wounds heal much more quickly than after electrocoagulation. The author thinks combined electrotomy and radium is the method of choice for skin cancers.—*Audrey G. Morgan.*

v. Schubert, Erich. Über Karzinomtherapie mit extrem harten Röntgenstrahlen. (Treatment of carcinoma with extremely hard roentgen rays.) *Strahlentherapie*, 1931, *42*, 136–142.

Efforts have been made to increase the hardness of roentgen rays until they approximate that of radium rays. But the usual roentgen rays are produced with a tension of about 200,000 volts while radium rays would correspond to ones produced with a tension of 1–2 million volts. But so far no apparatus and tubes for such tensions have been produced. The Sanitas Electrical Company has produced a gammavolt apparatus that works with 600,000 volts but no tubes have yet been made that can stand that tension. But the new AEG tubes can stand 400,000 volts or even 500,000. With the use of these enormous tensions, however, there is increasing danger from the current.

The author describes a plan that he has worked out in which there is no part carrying a current in the treatment room. The rays enter the room from beneath through a window provided with a filter which also excludes injurious gases. The gammavolt apparatus is put in a machine room on the ground floor with the treatment room beside it. There is a cellar beneath the treatment room in which the tubes and their connections are placed. The ceiling and walls of this cellar are covered with lead 15 mm. thick so that the rays can only enter the treatment room through an opening with adjustable diaphragms and filters. Large ventilators and electrical stoves are provided to keep the moisture down to 30–40 per cent. There is a large chest lined with lead in the treatment room in which the patient is placed. Its floor is made of thin wood and can be raised and lowered so as to adjust the focus-skin distance. The tubes can also be moved up and down. To protect the personnel there is a movable chamber in the treatment room lined with 4 mm. lead and with a window opening outside. Every precaution is taken to avoid injury of anyone entering the machine room.

Observations have been made of the effect of these extremely hard rays on the skin and blood. With a dosage of 2,000 r on a skin field in ten days there was no injury of the skin or of the bladder and rectum. On the use of 3,400 r there was a considerable fall of leucocytes but with no subjective disturbance. A circular field 230 sq. cm. in area front and back is used. The time is too short to pass judgment on the clinical results, particularly as only hopeless cases have been given the treatment in order to test the effect on the skin and blood. In one case of inoperable carcinoma of the ovary the resistance in the pelvis disappeared but a metastasis developed some weeks later in a supraclavicular gland. In one case of carcinoma of the cervix with a very large crater the hemorrhage and pain stopped and the infiltration decreased but did not disappear entirely. In this and another very severe case radium irradiation was given later in order not to lose any chance of success. The chief field for the use of this expensive and complicated method is in advanced cases with extensive infiltration of the parametrium in which radium is ordinarily used with the hope that these extremely hard rays may have effects similar to those of radium.—*Audrey G. Morgan.*

v. Spindler, A. Ausschaltung der Nierenfunktion bei der Ureterfistelbestrahlung? (Is kidney function arrested in irradiation of ureteral fistula?) *Strahlentherapie*, 1931, *41*, 336–340.

It has been held that ureteral fistulas can be dried up by irradiating the kidney with 90 per cent of a skin erythema dose as that stops kidney secretion. The kidney has never been considered particularly radiosensitive and even cases of kidney insufficiency have been treated with large doses of roentgen rays. Injury of the kidneys has been definitely shown in animal experiment but the doses used were much higher than the doses ordinarily used in man and even with these doses the excretion of urine was not stopped completely. Domagk saw a case in which the kidney region had been intensely irradiated by mistake in a child; after a few months a glomerulonephritis developed that caused death. The author does not think the findings justify Domagk's conclusion that the nephritis was the result of the irradiation.

Therapeutic experience in man shows on critical examination that the secretion of urine is not stopped. The author describes a number of cases in which the kidneys were irradiated with from 85 to 100 per cent of a skin erythema

dose after operation; histological examination showed that the kidneys were not injured. In one case in which a kidney fistula developed after a nephrolithotomy the kidney was irradiated with 90 per cent of a skin erythema dose and on the third day the fistula was dry. But an intravenous pyelogram ten days later showed that the secretion of urine had not stopped. In the cases in which fistulas have dried up after roentgen irradiation it must be assumed that the irradiation had something to do with the drying up of the fistulas, but the way in which this action is brought about is not clear. The author is doing experimental work in an effort to clear up this point.—*Audrey G. Morgan.*

DAUTWITZ, FRITZ. Über äussere Radiumbestrahlung beim Ulkusleiden und bei dessen postoperativen Beschwerden. (External radium treatment in ulcer and its postoperative sequels.) *Strahlentherapie*, 1931, *42*, 219–248.

Twenty-five cases of ulcer of the stomach and duodenum treated by external radium irradiation are described. The observation time extends over more than ten years. Radium was used only in cases in which medical or surgical treatment had failed. Among the 25 patients 17 had been operated on. Four were sent in with a diagnosis of carcinoma, but the further course of the disease indicated that they were really ulcer.

The patients were irradiated daily or every other day, a series consisting of 4 to 11 irradiations of the body surface for eight or nine hours; one patient was given 18 four-hour irradiations. Eighteen of the patients were given only one series, 4 two series and 3 three series. Five fields were irradiated, 3 in front and 2 behind with an apparatus placed at a distance of 3–4 cm. and filtered with 1.5 mm. lead. The total dose in one case reached 13,700 milligram-hours and was not less than 2,000 mg-hr. in any case. In cases of hyperacidity the dosage was from 2,161 to 2,170 mg-hr., in ulcer of the stomach 2,400–5,695 mg-hr., in ulcer of the duodenum 9,470 mg-hr., in pylorospasm 3,664 mg-hr. and in the cases sent with a diagnosis of carcinoma 5,400 to 11,360 mg-hr. The size of the dose and the number of irradiations depended on the case. The patients given large doses for carcinoma were not injured in any way.

Among the 25 cases there was only one of peptic ulcer of the jejunum in which the radium treatment did not have any primary effect and there were only 4 in which there was no late effect. No other treatment was given in any of these cases; the results would probably be better if irradiation was associated with medical treatment. Roentgen sickness is one of the reasons for not using roentgen irradiation in inoperable stomach ulcer. There was little or no sickness in these cases treated with radium. No late injuries of the skin or internal organs have been observed.

No satisfactory explanation is known of the nature of the action of radium in ulcer. Some authors hold that it is brought about by alkalinization of the body, others by indirect action on the nerves. A further study of the effect of radium in diseases other than cancer will contribute greatly to general knowledge in regard to the nature of the action of radium rays.—*Audrey G. Morgan.*

RAILLIET, DELATTRE, GINSBOURG and NICOLLE. Syndrome hypogranulocytaire mortel. Essai de traitement par la radium. (Fatal agranulocytic syndrome. Attempt at treatment by radium.) *Bull. et mém. Soc. méd. de hôp. de Par.*, Nov. 9, 1931, *55*, 1594–1596.

This is a report of a case of acute agranulocytosis with anemic and hemorrhagic syndromes following arsenical treatment. A veneer of wax, 0.007 mm. thick, was applied over the diaphyses of the long bones. Tubes of radium element were placed longitudinally along the axis of the extremities: two tubes of 10 milligrams each over each tibia, six tubes of 1 mg. over each femur, one tube of 10 mg. on each humerus. The treatment lasted three days, giving a total dosage of 10.70 millicuries-destroyed (1,423 milligram-hours*) to each tibia, 3.24 millicuries-destroyed (430 milligram-hours*) to each femur, 5.35 millicuries-destroyed (711 milligram hours*) to each humerus. The leucocyte count was 500 before treatment and 700 after treatment. Had the patient lived this treatment was to have been repeated in two weeks.—*Ellsworth Johnson.*

* Abstractor's computation.